Muelleria

Volume 7

Number 4

April 1992

NATIONAL HERBARIUM OF VICTORIA

DEPARTMENT OF CONSERVATION & ENVIRONMENT

Muelleria

Volume 7, Number 4

April 1992

CONTENTS

Volume 7, Number 4 Page

Plectranthus blakei (Lamiaceae), a new species from central Queensland
— Paul I. Forster 417
A note on *Plagiocarpus* Benth. (Fabaceae: Brongniartieae)
— J.H. Ross 421
The setaceous species of *Batrachospermum* (Rhodophyta): a re-evaluation of *B. atrum* (Hudson) Harvey and *B. puiggarianum* Grunow including the description of *B. diatyches* sp. nov. from Tasmania, Australia
— T.J. Entwisle 425
A new species of *Pomaderris* Labill. (Rhamnaceae) from north-east Victoria
— N.G. Walsh 447
New taxa in Victorian Poaceae (2)
— N.G. Walsh 451
Chromosome number determinations in *Brachyscome* Cass. (Asteraceae: Astereae) with comments on species delimination, relationships and cytogeography
— K. Watanabe and P.S. Short 457
Alpine botanical expeditions of Ferdinand Mueller
— Linden Gillbank 473
Ptilotus eriotrichus (Amaranthaceae) revisited
— P.S. Short 491
Lectotypification of *Fumaria muralis* Sond. ex Koch (Fumariaceae)
— N.G. Walsh 495
Two new species of *Eucalyptus* (Myrtaceae) in south-eastern Australia
— K. Rule 497
A new species and new records from the Tasmanian lichen flora
— Gintaras Kantvilas & John A. Elix 507
Some nomenclatural changes in the Angianthinae and Cassiniinae (Asteraceae: Gnaphalieae)
— Paul G. Wilson, P.S. Short & A.E. Orchard 519
A new species of *Lobelia* L. (Campanulaceae: Lobelioideae) from Victoria and South Australia
— David Albrecht 525
'Such ingenious Birds': Ferdinand Mueller and William Swainson in Victoria
— Sara Maroske & Helen M. Cohn 529
Book Review: A taxonomic revision of *Lamium* (Lamiaceae)
— R. Spencer 555
Book Review: The Macmillan Dictionary of the Australian Environment
— Timothy J. Entwisle 557

Editor: D.B. Foreman

Published by the National Herbarium of Victoria (MEL),
Birdwood Avenue, South Yarra, Victoria, 3141, Australia.

The date of distribution of **Volume 7, Number 3** was 18 March 1991.

PLECTRANTHUS BLAKEI (LAMIACEAE), A NEW SPECIES FROM CENTRAL QUEENSLAND

by

PAUL I. FORSTER*

ABSTRACT

Forster, P.I. *Plectranthus blakei* (Lamiaceae), a new species from central Queensland. *Muelleria* 7(4): 417–420 (1992). — *Plectranthus blakei* P. Forster *sp. nov.*, from the Blackdown Tableland area, central Queensland is described with notes on its affinities, habitat and conservation status.

INTRODUCTION

In May 1984 I visited Blackdown Tableland National Park in central Queensland, and collected plants of a *Plectranthus*. This taxon had been previously collected from Blackdown Tableland on a small number of occasions. The two earliest collections *Gittins 906* and *Johnson 1102* were mentioned by Blake (1971, p 40) in his account of *P. parviflorus* with the comment that 'These two collections may represent an undescribed species'.

Although Blake did eventually study live material in 1971 and 1972, he never followed up his comment and the material has remained undetermined at the Queensland Herbarium. Using the key published by Blake (1971) for his revision of *Plectranthus* in Australia and adjacent regions, live material was keyed to *P. apreptus* S.T. Blake described from the wet tropics of north Queensland. In a number of characters the Blackdown Tableland material was also similar to *P. gratus* S.T. Blake and the recently described *P. arenicola* ('*arenicolus*') P. Forster (Forster 1991); however, it differed significantly in a number of characters from all three of these species. It is described here as a new species.

TAXONOMY

Plectranthus blakei P.Forster sp. nov. affinis *P. aprepto* S.T. Blake a quo glandulis sessilibus in caulibus, foliorum lamina glauca supra et indumento flavido utrinque, corolla 13–16 mm longa differt.

TYPUS: Queensland, Leichhardt District — Mimosa Creek near aboriginal art, Blackdown Tableland National Park, 23° 48′S, 149°05′E, 16.v.1984, *P.I. Forster 1782* (HOLOTYPUS: BRI, 2 sheets. ISOTYPI: CANB, K, MEL, NSW *distribuendi*).

ILLUSTRATION: K.A.W. Williams, Native Pl. Queensland 1: 238–239 (1979) [as *Plectranthus* sp.]

Subshrub to 40 cm high, foliage sweetly scented. *Stems* or lateral branches erect, the lower woody part often straggling and up to 6 mm thick, with a thickened, somewhat tuberous base; upper parts with a dense indumentum of antrorse 4–5-celled yellow hairs up to 1 mm in length but commonly much shorter, occasional gland-tipped trichomes and many sessile, yellow glands particularly below the inflorescence. *Leaves* long-petiolate; lamina ovate to deltoid, 2–6 cm long, 12–40 mm wide, dull green, fleshy, paler beneath, not colouring purplish in strong light; serrate to dentate with 7–12 pairs of short broad teeth, rarely with 1 or more secondary teeth; with dense indumentum of clear to yellow antrorse hairs on both surfaces; many sessile yellow glands below, few to none above; veins impressed above, prominent below; petiole 10–30 mm long, 1.7–2 mm diameter.

* Queensland Herbarium, Meiers Road, Indooroopilly, Queensland, Australia 4068.

Inflorescence cymose comprising 1(3) branches; each branch pedunculate, 10–30 cm long, *c.* 2 mm diameter; axis with sparse indumentum of yellow antrorse hairs and minute gland-tipped hairs, scattered sessile glands. *Verticillasters* 4–9 flowered, 12–22 mm apart; pedicels 4–5 mm long, 0.5–0.7 mm diameter, with dense indumentum of gland-tipped trichomes. *Calyx* 2.7–3 mm long, with a dense indumentum of gland-tipped and eglandular trichomes and sessile, yellow glands. *Corolla* 13–16 mm long, lilac-blue; tube 7–8 mm long, abruptly curved below middle making an angle of 90–120°, slightly inflated upwards and then constricted to the slightly oblique mouth, glabrous; upper lobes 4–4.1 mm long, 3–3.2 mm wide, subcircular, standing more or less erect at between 90 and 110° to the lip, with sparse eglandular trichomes, no sessile yellow glands; lateral lobes 3–3.2 mm long, 1–1.7 mm wide, white in middle, with sparse eglandular trichomes, no sessile yellow glands; lower lip 9–10 mm long, 8–9.5 mm wide, oblique, with sparse eglandular trichomes, no sessile yellow glands. *Style* purplish-blue, 13–15 mm long, *c.* 1 mm diameter. *Stamens* 4, 7–9 mm long, *c.* 0.2 mm diameter, fused to the tube in the bottom for *c.* 5 mm; anthers *c.* 0.5 mm long and 0.3 mm wide. *Fruiting calyx* 4.5–5 mm long, with glandular and eglandular trichomes and sessile yellow glands; upper lobes *c.* 4 mm long and 2.5 mm wide, broadly ovate, tip acute; lateral

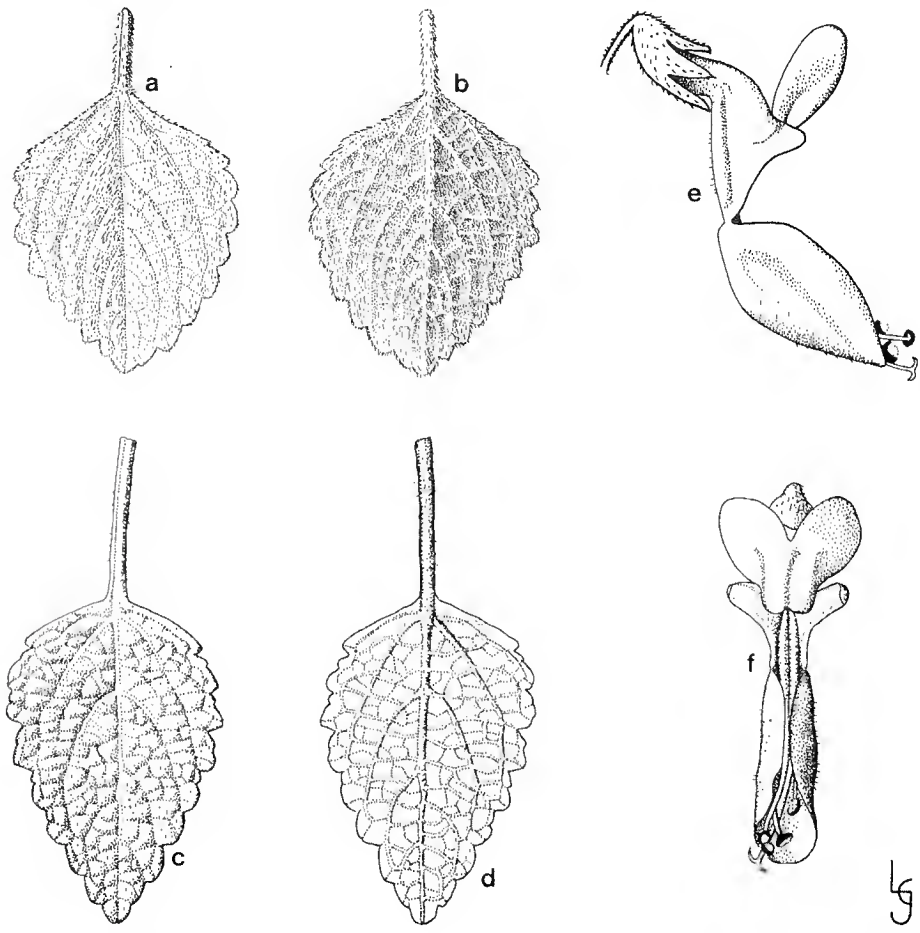


Fig. 1. a-b, e-f — *Plectranthus blakei* (*Forster 1782*). c-d — *P. apreptus* (*Forster 4346 & Tucker*). a & c — upper leaf surface ×1. b & d — lower leaf surface ×1. e — side view of flower ×5. f — face view of flower ×5. *Del. L.G. Jessup.*

lobes lanceolate, *c.* 1.5 mm long and 1 mm wide; lower lobes lanceolate, *c.* 3 mm long and 1 mm wide, incurved; tube 3–3.5 mm long. *Seed* flattened, spherical, 0.9–1 mm long, 0.7–0.8 mm wide, *c.* 0.4 mm thick. (Fig. 1)

ETYMOLOGY:

Named for Stanley Thatcher Blake (1911–1973), a former member of staff at the Queensland Herbarium (BRI) who provided the first revision of the genus *Plectranthus* in Australia and made a tremendous contribution both to the herbarium collections of Australian plants at that institution (over 23 000 numbers) and to Australian taxonomic botanical literature (Everist 1976).

DISTRIBUTION AND CONSERVATION STATUS:

Plectranthus blakei is only known from the Blackdown Tableland in the Leichhardt district in southern central Queensland which is an area of raised sandstone escarpments (Henderson 1976). Much of the Blackdown Tableland is now a National Park and most of the collections of this plant have been from within the Park boundaries. An appropriate conservation coding is 2RC (Briggs & Leigh 1989).

HABITAT NOTES:

Plants of *P. blakei* grow on sandstone rock outcrops and ledges surrounded by open eucalypt-dominated forest at altitudes of 800–900 m. Other plants growing in close association include *Hoya australis* subsp. *australis*, *Calandrinia pickeringii, C. pleiopetala, Plectranthus parviflorus* and *Portulaca bicolor.*

AFFINITIES:

Plectranthus blakei belongs to the complex of species comprising *P. apreptus*, *P. arenicola* and *P. gratus* from Australia and *P. forsteri* Benth. from the Pacific. The major diagnostic features of the four Australian species are compared in Table 1. It should be noted that although Blake (1971) describes the leaves of *P. apreptus* as dull green, in his accompanying illustration of a live plant they are distinctly glossy and this is the case with the live material that I have examined (*Forster 4346 & Tucker*; BRI,CBG,K,L,MEL,NSW,QRS).

Both *Plectranthus arenicola* and *P. blakei* can be keyed in Blake's key, if the couplets leading into *P. gratus*, *P. forsteri* and *P. apreptus* are replaced with the following:

Leaf teeth pairs 3–6:

Stems with thickened tuberous base; hairs on stem to 2.7 mm long; floral axis without sessile glands; corolla 11–12 mm long..... *P. arenicola*

Stems without thickened tuberous base; hairs on stem to 0.55 mm long; floral axis with sessile glands; corolla 3–8 mm long..... *P. forsteri*

Table 1. Comparison of characters for Australian *Plectranthus* species allied to *P. blakei.*

Character	Species			
	apreptus	*arenicola*	*blakei*	*gratus*
stems with sessile glands	—	—	+	+
maximum length of hairs on stem (mm)	1.2	2.7	1.0	1.0
stems with thickened ± tuberous base	—	+	+	—
number of leaf teeth pairs	7–15	4–6	7–12	3–6
leaves with sessile glands above	—	—	+	+
upper leaf surface glossy	+	—	—	—
floral axis with sessile glands	+	—	+	+
number of flowers per verticillaster	6–10	10	4–9	10–20
distance between verticillasters (mm)	5–20	11–12	12–22	7–13
pedicel length (mm)	2.5–7.5	3–4	4–5	2.5–5
corolla length (mm)	7–12	11–12	13–16	7–11

Leaf teeth pairs 7–23:

Stems with thickened tuberous base; leaf indumentum drying yellow; corolla 13–16 mm long ..... *P. blakei*

Stems without thickened tuberous base; leaf indumentum drying clear; corolla 7–12 mm long:

Stems with sessile glands; upper leaf surface dull; verticillasters with 10–20 flowers ..... *P. gratus*

Stems without sessile glands; upper leaf surface glossy; verticillasters with 6–10 flowers ..... *P. apreptus*

FURTHER SPECIMENS SEEN: (all BRI)

Queensland: Leichhardt District — Blackdown Tablcland, 12 miles SSE of Bluff, Two Mile Creek, 22.ix.1959, *R.W. Johnson 1102*; Blackdown Tableland, *c.* 32 km SE of Blackwater (campsite on Mimosa Creek), 20.iv.1971, *R.J. Henderson 699, S.B. Andrews & P. Sharpe*; Blackdown Tableland, *c.* 35 km SE of Blackwater (campsite at old stockyard on Mimosa Creek), *c.* 1.2 km WNW of campsite, 4.ix.1971, *R.J. Henderson 973, L. Durrington & P. Sharpe*; *c.* 6 km W of Forestry Camp on Mimosa Creek, Blackdown Tableland, 23°47′S, 149°07′E, 3.ix.1974, *K.A.W. Williams 74035*; Stony Creek track, Blackdown Tableland, *c.* 6.5 km W from Forestry Camp, Mimosa Creek, 23°49′S, 149°07′E, 7.ix.1974, *K.A.W. Williams 74050*; Rockland Spring about 24 miles SW of Dingo, 23°55′S, 149°00′E, 22.ix.1959, *C.H. Gittins 906. Moreton District* — Cultivated at The Gap, Brisbane (ex Blackdown Tableland), xi.1971, *S.T. Blake 23750*; *ibid*, ix.1972, *S.T. Blake 23791.*

ACKNOWLEDGEMENTS

L.G. Jessup provided the drawings. L. Pedley provided the Latin translation of the diagnosis. Permission to collect in Blackdown National Park was granted by the Queensland National Parks and Wildlife Service and assistance in the field was provided at the time by S. Pearson.

REFERENCES

Blake, S.T. (1971). A revision of *Plectranthus* (Labiatae) in Australasia. *Contrib. Qld. Herb.* No. 9: 1–120.

Briggs, J.D. & Leigh, J.H. (1989). 'Rare or threatened Australian plants 1988 revised edition.' (Special publication no. 14. Aust. Natl Parks & Wildlife Serv.: Canberra.)

Everist, S.L. (1974). Stanley Thatcher Blake — botanist extraordinary. *Queensland Nat.* 21: 31–32.

Forster, P.I. (1991). *Plectranthus arenicolus* (Lamiaceae), a new species from Cape York Peninsula, Queensland. *Muelleria* 7: 375–378.

Henderson, R.J.F. (1976). History and floristics of the Blackdown Tableland, central Queensland. *Queensland Nat.* 21: 119–124.

Manuscript received 21 November 1990; revised 3 April 1991.

A NOTE ON *PLAGIOCARPUS* Benth. (FABACEAE: BRONGNIARTIEAE)

by

J.H. Ross*

ABSTRACT

Ross, J.H. A note on *Plagiocarpus* Benth. (Fabaceae: Brongniartieae). *Muelleria* 7(4): 421–423 (1992). — *Plagiocarpus* is reviewed and the conclusions contained in an unpublished manuscript prepared by the late John Maconochie are evaluated. A lectotype of *Plagiocarpus axillaris* is selected.

INTRODUCTION

Bentham (1873) based his description of the genus *Plagiocarpus* on material from northern Australia collected by A. Cunningham from Greville Island, Regent's River, and by Schultz from Port Darwin. Bentham indicated that he had long known the plant collected by Cunningham in 1821 but could not refer it to any known genus as he 'was unable to characterise it for want of the flowers, which we have now received in Schultz's rich Port Darwin collections'.

Bentham hesitantly referred *Plagiocarpus* to the tribe Galegeae, but the genus is now placed in the tribe Brongniartiaeae (Crisp & Weston, 1987). *Plagiocarpus* differs from *Hovea*, *Lamprolobium* and *Templetonia*, the other Australian genera in the tribe, in having sessile mostly digitately 3-foliolate leaves, subsessile solitary axillary flowers with linear bracteoles, and seeds with nearly circular arils.

DISCUSSION

About fifteen years ago the late John Maconochie concluded that there were two species in *Plagiocarpus*, that the name *P. axillaris* applied to an uncommon taxon of restricted distribution in the Northern Territory, and that a name was required for the widespread taxon to which the name *P. axillaris* had been misapplied. He annotated specimens accordingly and submitted a manuscript for publication which was returned to him for modification after being refereed. Unfortunately he did not live to effect any changes and a revised manuscript was never published.

Plagiocarpus is one of the genera I undertook to write up for the *Flora of Australia* and I have recently had occasion to study material. I have had the benefit of locating an early draft of Maconochie's manuscript and of examining a wider range of material than he saw. Unfortunately I am not in agreement with his conclusions.

Maconochie differentiated the two species on leaflet shape, width and indumentum, and on the nature of the indumentum. Examination of the material of *Plagiocarpus* reveals a considerable amount of variation in leaflet size, shape and indumentum and in the indumentum of the stems. Leaflet shape and size are not necessarily correlated with indumentum although there is a tendency for specimens with narrow leaflets to be more densely pubescent than those with broad leaflets. Two specimens from the Port Keats area in the Northern Territory, namely *C.S. Robinson MMR 24.21* (DNA) and *G. Wightman 598 & C. Dunlop* (DNA), and the Schultz syntypes in K have stems clothed with appressed hairs up to 1mm long and sparingly pubescent obovate-oblong or oblong leaflets and they tend to look different from much of the other material which is densely clothed with silvery-white villous hairs and has narrower leaflets which are more promi-

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia, 3141.

Fig. 1. The known distribution of *Plagiocarpus axillaris*.

nently mucronate apically. However, these four specimens appear to represent no more than one extreme of a range of almost continuous variation.

Although the extremes look different, neither leaflet shape nor size, nor the indumentum of the leaflets or stems, either singly or in combination, separate the material into two well defined taxa. Furthermore, I have not detected any significant differences in the flowers, fruits or seeds in the material examined or in the ecological preferences that would facilitate the recognition of two taxa. Consequently I propose to regard all of the material as belonging to one variable species.

There are in K four sheets of type material, two collected by *Schultz (639 and 639 bis)* and two by *Cunningham (192/1821* and *s.n.)*. The Schultz syntypes tend to have shorter hairs on the leaflets and stems and to be less densely pubescent than the Cunningham specimens. Maconochie nominated and labelled the sheet of Cunningham material in K, to which is pinned a set of pencil line drawings of floral parts, as the lectotype of *P. axillaris*. This was a curious choice because the Cunningham specimens agree with the material that he referred to his new species far more closely than do the Schultz syntypes. As the Schultz material was critical to Bentham and enabled him to place this species in his new genus, I here select *Schultz 639* in K as the lectotype of *Plagiocarpus axillaris*. Despite the fact that Port Darwin appears on the label, doubt exists that the specimen was actually collected at Darwin.

Plagiocarpus axillaris Benth. in Hook., *Icon. Pl.* 12: t.1162 (1873).

LECTOTYPE (here selected): Northern Territory, Port Darwin, *Schultz 639* (K).

Shrub or subshrub to 1 m high, stems densely clothed with appressed to spreading hairs up to 2 mm long, the hairs tawny or more usually silvery-white. *Leaves* sessile, usually 3-foliolate but basal ones sometimes simple: leaflets elliptic-oblong to obovate-oblong, oblong or obovate, 1–2.8 cm long, 0.3–0.9 cm wide, rounded or obtuse apically with a short mucro *c.* 0.5 mm long or gradually narrowed apically and with a mucro up to 1.2 mm long, sparingly to densely clothed with short appressed hairs up to 1mm long or with spreading villous silvery hairs up to 2 mm long which obscure the surface. *Stipules* not evident. *Flowers* solitary, axillary, pale yellow, subsessile or on pedicels up to 1.5 mm long; bracteoles *c.* 1 mm long and 0.3 mm wide, densely pubescent and easily over-

looked as is the bract; bract *c.* 0.7 mm long, inserted *c.* 0.5 mm below the bracteoles, densely pubescent. *Calyx* densely pubescent, about half as long as the corolla; 2 upper lobes 4.5–5 mm long including the tube 1.5–2.5 mm long, 3 lower lobes 2–3.5 mm long, as long as or longer than the tube. *Standard* ovate, slightly cordate basally, 10–11mm long including a claw 2–2.5 mm long, 7.2–8.1 mm wide; wings 9.5–10.4 mm long including a claw 0.75–1.5 mm long, 3.5–4.2 mm wide; keel petals 9.5–10.5 mm long including a claw 1.2–2 mm long, 3.5–4 mm wide. *Stamen-filaments* 8.2–11 mm long. *Ovary c.* 2 mm long, glabrous, 2-ovulate; style 8.6–9.5 mm long. *Pods* sessile or almost so, obliquely ellipsoid, 1–1.1 cm long, 0.5–0.6 cm wide, 1–2-seeded, glabrous, dehiscent. *Seeds* ellipsoid, 4.5–6.2 mm long, 3–3.7 mm wide, olive-to reddish-brown, with a small aril surrounded by a collar-like lipped aril.

Plagiocarpus axillaris occurs in the Kimberley region of Western Australia and in the north-western Northern Territory where it is recorded from the Katherine Gorge National Park, the Port Keats area and Kakadu National Park (Fig. 1). It is usually associated with sandstone cliffs or scree slopes but is sometimes found on sandy soils which are the erosional products from sandstone.

Representative Specimens (total number examined 37):

Western Australia — Headwaters of Packsaddle Creek, Northern Carr Boyd Ranges, 8.iii.1978, *T.G.Hartley 14404* (DNA,CANB,MEL,PERTH); Cockburn Range, 46 km SSE of Wyndham, 16.iii.1978, *M. Lazarides 8578* (CANB,PERTH); near Solea Falls, Drysdale River National Park, 12.viii.1975, *A.S.George 13755* (PERTH).

Northern Territory — Port Keats, 19.ix.1972, *C.S.Robinson s.n.* (DNA); Katherine Gorge National Park, 24.iii.1971, *N.Byrnes 1825* (CANB,DNA,MEL,PERTH).

ACKNOWLEDGEMENTS

I am most grateful to the Keeper of K and the Curators of CANB, DNA and PERTH for the loan of specimens.

REFERENCES

Bentham, G. (1873) *Plagiocarpus axillaris* in Hooker's, *Icones Plantarum* 12: t.1162.

Crisp, M.D. & Weston, P.S. (1987) Cladistics and Legume Systematics, with an analysis of the Bossiaeeae, Brongniartieae and Mirbelieae. *In* C.H.Stirton (ed.) Advances in Legume Systematics 3: 65–130. Royal Botanic Gardens, Kew.

Manuscript received 28 December 1990.

THE SETACEOUS SPECIES OF *BATRACHOSPERMUM* (RHODOPHYTA): A RE-EVALUATION OF *B. ATRUM* (Hudson) Harvey AND *B. PUIGGARIANUM* Grunow INCLUDING THE DESCRIPTION OF *B. DIATYCHES* SP. NOV. FROM TASMANIA, AUSTRALIA.

by

T.J. Entwisle*

ABSTRACT

Entwisle, T.J. The setaceous species of *Batrachospermum* (Rhodophyta): a re-evaluation of *B. atrum* (Hudson) Harvey and *B. puiggarianum* Grunow including the description of *B. diatyches sp. nov.* from Tasmania, Australia. *Muelleria* 7(4): 425–445 (1992). — Species concepts among the setaceous *Batrachospermum* (those species with compact gonimoblasts which are exserted beyond reduced whorls of fascicles) are clarified. *Batrachospermum atrum* (Hudson) Harvey is a widespread and variable species throughout the world, ranging between two extreme growth forms: one with mostly cylindrical cells in little-branched fascicles forming relatively open whorls, the other with more rounded or barrel-shaped cells in richly-branched fascicles forming compact whorls. Mature plants of *B. puiggarianum* Grunow, from southern-central Africa and South America, are similar to those of *B. atrum* with compact whorls, but young thalli of *B. puiggarianum* are quite distinct, bearing reduced fascicles which form a tight cortical layer around the axial filament (individual fascicle structure not being discernible). *Batrachospermum diatyches* Entwisle *sp. nov.*, a littoral alga found only in a few mountain lakes in Tasmania, Australia, differs substantially from the other two setaceous *Batrachospermum* species. The thallus apex is blunt rather than acute with the large apical cell (> 10 µm diameter) overtopped by the first whorls of primary laterals; the axial cells are 2.5 times the diameter of the broad (> 9 µm diameter) rhizoidal filaments; and the fascicles consist of tapered, scarcely branched filaments without constrictions at the crosswalls. Historical remarks on *B. atrum*, *B. gallaei* var. *longipilum* Skuja *nom. nud.* and *B. nothogeae* Skuja *nom. nud.* are provided, incorporating some previously unpublished illustrations, correspondence and notes of Heinrichs Skuja. The reputedly setaceous species, *B. africanum* Rabenhorst, *B. orthostichum* Skuja, *B. patens* Suhr and *B. tenuissimum* Bory are re-evaluated.

INTRODUCTION

The setaceous species of *Batrachospermum* have compact, globular or semi-globular gonimoblasts which protrude beyond the reduced (short and little-branched) whorls of lateral fascicles. The carpogonial branches are relatively straight and bear symmetrical carpogonia like those found in species with more robust whorl fascicles such as *B. virgatum* (Kützing) Sirodot. For this reason, the setaceous species have been recently included in a broadly circumscribed section *Viridia* Sirodot (Necchi 1990, Necchi & Entwisle 1990).

Earlier authors (e.g. Israelson 1942, Mori 1975) retained the grouping devised by Sirodot (1884), which included all setaceous species in their own section, *Setacea* Sirodot. The discovery of taxa with whorl development intermediate between typical *Setacea* and the 'well-developed whorl' morphology more commonly found in *Batrachospermum*, and of 'reduced whorl' plants with contorted or twisted carpogonial branches (usually referred to the section *Contorta* Skuja), has made the circumscription of the section *Setacea* inconsistent and impractical (Necchi & Entwisle 1990). Nevertheless, the algae traditionally relegated to the

* National Herbarium of Victoria, Birdwood Ave, South Yarra, Victoria, Australia 3141.

section *Setacea* are centred around an entity generally called *B. atrum* (= *B. dillenii*). The full morphological range expressed by members of this species complex had to be established before any putative taxa displaying reduced whorl morphology could be either synonymized with *B. atrum* or established as independent entities. Algae collected sporadically over the last 75 years from New South Wales and Tasmania included material of at least one distinctive setaceous *Batrachospermum*.

This re-evaluation of the setaceous *Batrachospermum* species is based on extensive fresh collections from south-eastern Australia, herbarium material from Australia, New Zealand, Europe and South and North America, unpublished notes, letters and illustrations by Heinrich Skuja, and relevant protologues and other published literature.

MATERIALS AND METHODS

Wet material was preserved initially in 5% commercial formalin which was later replaced with FAA (see Entwisle 1989) or 70% alcohol with 5% glycerol. Dry material prepared for microscopic observations was rehydrated with 20% detergent solution and gently heated. All microscope preparations were stained with 1% aniline blue (with 4% molar HCl) and mounted in 'Karo'. Herbarium abbreviations follow Holmgren *et al.* 1981.

Key to Species

1. Thallus apex blunt, apical cell overtopped by primary laterals; axial cells < 2.5 times the diameter of the rhizoidal filaments..... 1. *B. diatyches*
1. Thallus apex acute, apical cell protruding from beyond primary laterals; axial cells > 2.5 times the diameter of the rhizoidal filaments.....2
2. Fascicle structure discernible at least in young whorls; 2-celled primary laterals occurring within the first 10 axial cells from apex..... 2. *B. atrum*
2. Fascicle structure always indiscernible (young thalli tightly corticated, almost as found in the Lemaneaceae); 2-celled primary laterals usually not occurring within 10 axial cells of the apex ..... 3. *B. puiggarianum*

SPECIES ACCOUNTS

1. **Batrachospermum diatyches** Entwisle *sp. nov.*
Batrachospermum nothogeae Skuja *nom. nud., pro parte.*

Batrachospermum atrum affinis apicibut thallorum obtusis cellula inclose amen (majored 10 µm diametro), cellulis apicibus filamentous rhizoideorum minoribus 2.5 plo diametro, filamentis rhizoideorum latis (majoribus 9 µm diametro), et filamentis fasciculorum gradatim decrescentibus, septis non constrictus differt.

Holotypus: Lake Meston, north-central Tasmania. Epilithic in littoral zone of northern portion of lake. Water acidic (pH 5.7). Coll. *P.A. Tyler s.n.* 10.iii.1988, MEL 1587821. Isotypi: MEL 1587822, BM,SP,UPC.

Thalli entangled, individual plants firm, wiry, up to 6 cm long, 70–110 µm diameter (60–100 µm at internodes), dark-brown; branching irregular, sparse, acute to perpendicular. *Whorls* inconspicuous, reduced to ring of procumbent fascicles directed towards apex, separated; internodes 50–200 µm long. *Thallus apices* blunt, densely sheathed in fascicles; apical cell hemispherical, 7–13 µm long, 12–14 µm diameter; subsequent axial cells firstly discoid, then short-barrel shaped, and finally cylindrical; first laterals cut *c.* 2 axial cells back from apex, becoming 2-celled almost immediately; young fascicles open, intercalary cells cylindrical, 8–12 µm long, 6–10 µm diameter, L/D 1–1.5. *Young central axis* (100–500 µm from apical cell) consisting of axial cells 13–27 µm diameter,

clothed by rhizoidal filaments 10–15 μm diameter, axial cell 1.4–1.8 times broader than rhizoidal filaments. *Mature central axis* consisting of narrow axial cells, 22–28 μm diameter, clothed by regular layers (resulting in brick-like pattern of cells) of rhizoidal filaments, 10–16 μm diameter, axial cells < 2.5 times as broad as rhizoidal filaments. *Fascicles* 2 per pericentral cell (plus rhizoidal filament), finger-like, projected towards apex, unbranched (single lateral cells cut off distal cell are presumably spermatangial mother cells), tapering, not constricted at cross walls, cell storeys 4–6, branching 0–2 times; proximal cells initially cylindrical, becoming ovoid, 15–20 μm long, 8–10 μm diameter; intercalary cells more or less cylindrical, 8–12 μm long, 6–10 μm diameter; apical cell irregularly conical, apex rounded or pointed, 8–13 μm long, *c.* 10 μm diameter, terminated by hair, up to 90 μm long, which is apparently regularly shed and replaced (concentric empty cell-walls are often all that remains of the terminal hair). *Secondary fascicles* rare, usually single celled (multicellular secondary fascicles occurring sporadically in older thalli).

Plants monoecious. *Carpogonial branches* rare, borne on proximal cell of primary fascicle, protruding from whorl, 2–3 cells long, curved or straight, with compact, few-celled involucral bracts not overlapping trichogyne. *Carpogonia* 44–46 μm long; trichogyne elongate to swollen, fusiform to obovate, 32–38 μm long, 5–10 μm diameter. *Spermatangia* cut off obliquely from distal cell of primary fascicles, ellipsoid to obovoid, 8–10 μm long, 6–8 μm diameter. *Gonimoblast* usually 1 per whorl, sparse, more or less globular, protruding wart-like from primary fascicle whorl, centre displaced to one side of thallus, 80–220 μm in diameter; carposporangia obovoid to globular, 15–19 μm long, .6–18 μm diameter.

Audouinelloid filaments twining around older thalli presumably resulting from germinated carpospores (epiphytic 'Chantransia' stage) or else playing some attachment role. (Figs 1, 2a-b)

Diagnostic Features:

Batrachospermum diatyches is similar to *B. atrum* in habit and morphology but has blunt thallus apices with an embedded, large (> 10 μm diameter) apical cell; axial cells < 2.5 times the diameter of the broad (> 9 μm diameter) rhizoidal filaments; and fascicle filaments gradually tapering and not constricted at crosswalls.

Distribution & Habitat:

Western Tasmania in relatively high altitude (> 300 m above sea level), acidic (pH < 6) lakes. All collections made during summer and early-autumn.

Other Specimens Examined:

Tasmania — Lake Pedder, south-west Tasmania, 2.iii.1966, *P.A. Tyler 660302/2* (MEL); Dove Lake, Cradle Mountain area, - .ii.1928, *F. Perin s.n.* (NSW), 13.xii.1973, *A.B. Cribb 773.3 p.p.* (BRI).

Etymology:

The epithet '*diatyches*' [(Gk) *di-* = twice, *atyches* = unfortunate] alludes to two unfortunate events which occurred in 1972 and were associated with the discovery of this taxon:

1) the permanent flooding of Lake Pedder to provide a hydroelectricity facility, and
2) the death of Heinrichs Skuja (1892–1972) prior to his publishing on this new species.

Taxonomic Notes:

Only a few non-empty spermatangia were observed, so details of these structures are tentative. Carpogonia were also scarce, and all *N. diatyches* material

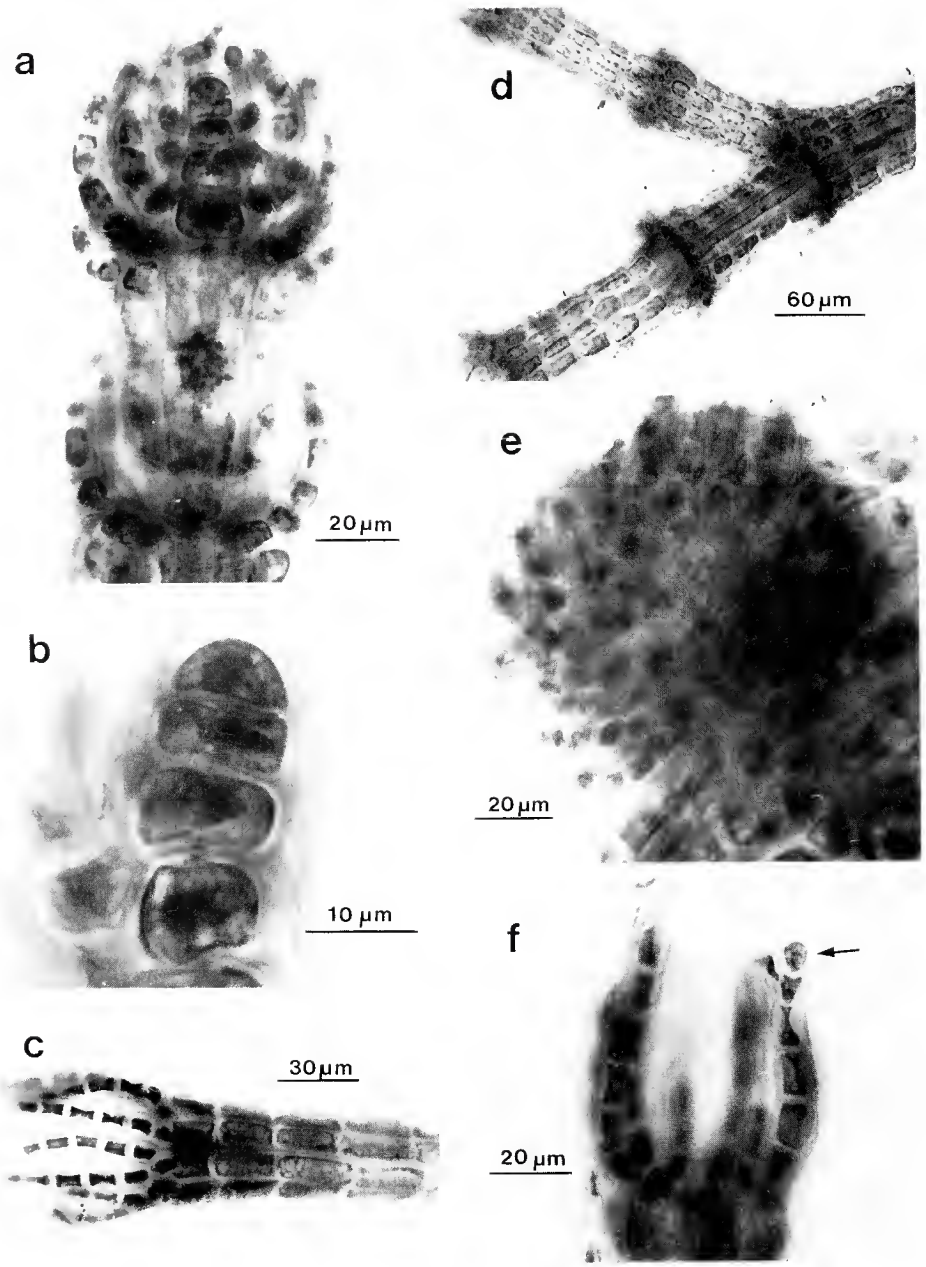


Fig. 1. *Batrachospermum diatyches*. a — thallus apex with apical cell overtopped by young fascicles (*Perin s.n.*). b — apical cell and first axial cells of thallus (first lateral fascicle directed out of plane of focus on left) (*Tyler s.n.*, iii.1988). c — whorl of fascicles and rhizoidal filaments in disassociated fragment (*Perin s.n.*). d — portion of mature thallus with axial cells in focus towards right and rhizoidal filaments towards left (*Tyler s.n.*, iii.1988). e — gonimoblast attached to thallus at bottom right (*Perin s.n.*). f — spermatangium (arrow) at tip of lateral fascicle (*Perin s.n.*).

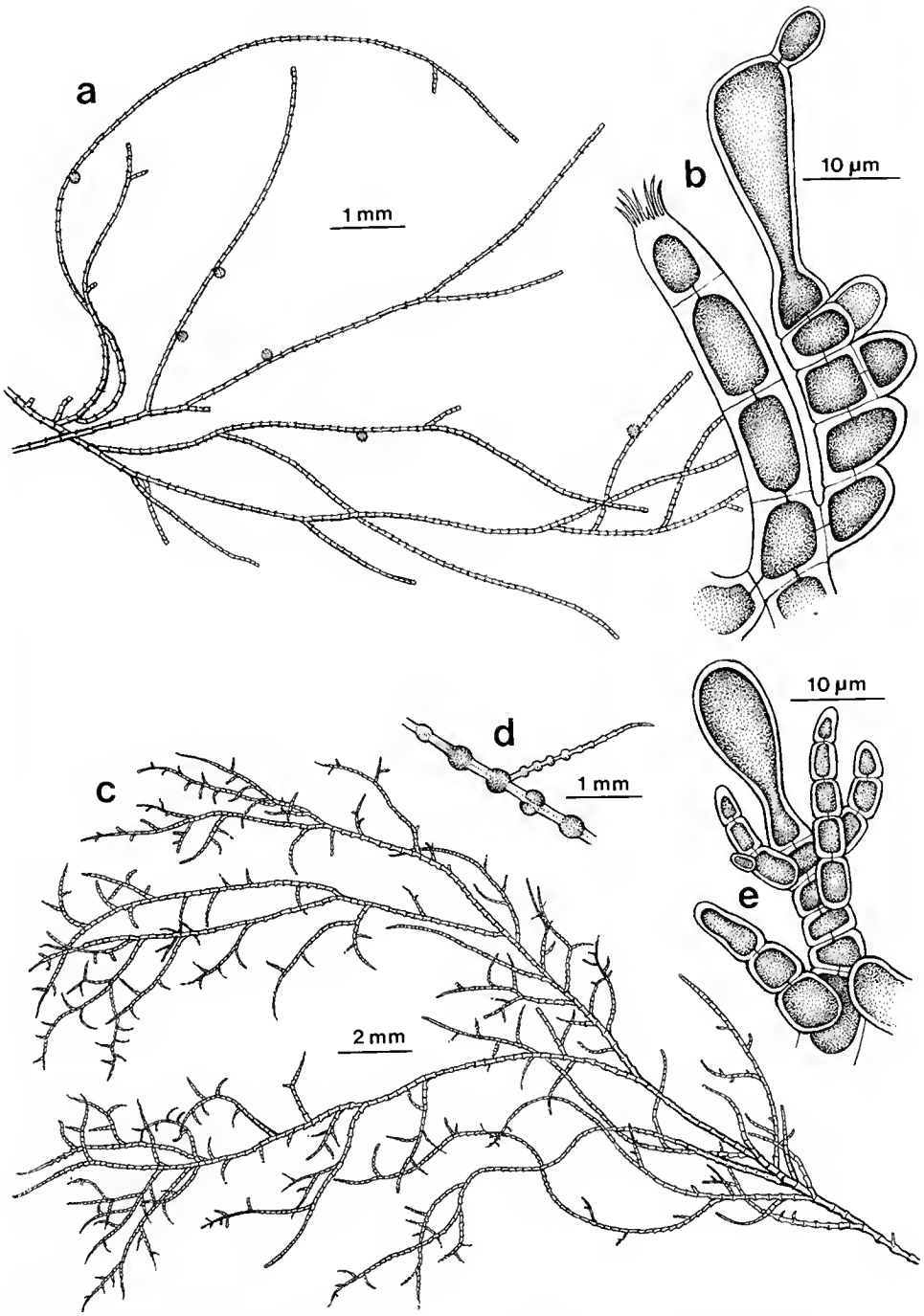


Fig. 2. a,b. *Batrachospermum diatyches* (*Tyler s.n.*, iii.1988). a — habit showing lateral, spherical gonimoblasts. b — carpogonial branch (right), bearing carpogonium with spermatium attached, arising from proximal cell of sterile lateral. Note distal cell wall remains of apparently deciduous hairs on sterile lateral, and 1-celled involucral bracts on cells subtending carpogonium. c-e. *Batrachospermum atrum*. c — habit (*Entwisle 1797*). d — wart-like gonimoblasts on main branch (*Entwisle 1566*). e — carpogonial branch with 3–5-celled, occasionally branched involucral bracts (*Entwisle 1668*).

observed was certainly less 'fertile' than *B. atrum*. Whether this reflects phenological behavior or a peculiarity of the species is not known.

HISTORICAL REMARKS:

In May 1968, Dr Peter Tyler (University of Tasmania) sent Heinrichs Skuja (University of Uppsala, Sweden) a batch of freshwater red algae from Tasmania. Represented in these collections were *B. vagum* (Roth) C.Agardh, *B. gallaei* var. *longipilum* nom. ms. Skuja (first found in New Zealand), and an undescribed setaceous species of *Batrachospermum* to which he had given the manuscript name '*B. nothogeae*[1]' (mentioned in Entwisle & Kraft 1984: 217). In a note scribbled on the letter accompanying these specimens, Skuja intimates that the Tasmanian plants might represent a new variety of '*B. nothogeae*'.

Skuja explained to Tyler that he already knew of Australian '*B. nothogeae*' from dried herbarium material sent to him in 1934. That specimen came from the Blue Mountains in NSW, collected by Dr L.H.S. Lucas in 1918. The only other locality of '*B. nothogeae*' known to Skuja was in the Faukland Islands (collected by Lechler in the 1850s from a creek near William Stanleys Haven). This collection was circulated as part of Hohenacker's Algae Marinae Siccatae (No. 307) under the name '*B moniliforme* Roth f. *Conferva atra* Dillwyn' (Skuja-Tyler corr. 13.v.1968)]. Skuja first determined this specimen as *B. dillenii* var. *nothogeae* nom. ms. (10.viii.1932), but later decided that the taxon warranted specific rank.

The Tasmanian '*B. nothogeae*' was collected in April 1966 from the shores of Lake Pedder, a glacial-formed lake in the mountainous south-west of the state. This pristine lake was characterised (up until 1972) by extensive beaches of quartzite sand washed by acidic, humic waters. Tyler promised to look for more *Batrachospermum nothogeae* in the lakes and streams of south-west Tasmania.

In February 1969, Dr Heinrich Skuja excitedly opened a parcel of wet-preserved algae from south-west Tasmania (Skuja-Tyler corr. 19.ii.1969). Disappointingly, although the vial contained good material of what Skuja knew as *B. gallaei* var. *longipilum* nom. ms. (also a setaceous species), there was no '*B. nothogeae*' to complete his description of that species (Skuja-Tyler corr. 19.ii.1969). Since none of Tyler's subsequent collections included '*B. nothogeae*', he sent the remainder of the 1966 collection to Skuja in March 1972.

In July 1972, Skuja died, apparently without having examined the latest batch of Tasmanian material (which also included two collections of *Batrachospermum* not referable to '*B. nothogeae*'). In the same year, Lake Pedder was flooded by the Tasmanian Hydroelectricity Commission in spite of years of intense lobbying by conservationists and environmentalists keen to preserve this lake's unique biology. The surface area of the lake increased by 25 times, and the sandy beach was destroyed.

Just over 10 years later (February 1983), I received a box of vials from Dr R. Moberg, Director of the University of Uppsala Herbarium. Included were 30 specimens from New Zealand and three specimens from Tasmania, all sent to Skuja in early 1972. Although many were dried out, some — including one of the three Tasmanian collections — were in excellent condition. The Tasmanian collections were obviously those sent by Tyler to Skuja in March 1972.

2. **Batrachospermum atrum** (Hudson) Harvey, *Man. brit. Alg.* 120 (1841). *Conferva atra* Hudson, *Fl. angl.* 597 (1798).

HETEROTYPIC SYNONYMS: *B. gallaei* Sirodot, *Batrachospermes* 256, pl. 22 figs 1–7 (1884).

B. dillenii Sirodot, *Batrachospermes* 254, pl. 20 figs 1,2, pl. 21 figs 1–12, pl. 22 figs 8–13 (1884).

---

[1] The etymology of the epithet '*nothogeae*' is unknown, but the name is presumably derived from the Greek *noth-* = false or spurious, and *-ge* = earth, possibly referring to its brown colour.

B. angolense W.West & G.S.West, *J. Bot.* 35: 2 (1897). *Sirodotia angolensis* (W.West & G.S.West) Skuja, *Bol. Soc. brot.* 34: 53 (1960).

Typus: From a little well, in the plain called Gors Bach, between Llanfaethly and Trefadog, Wales. Coll. *S. Brewer s.n.*, prior to 1741 (BM). [Photograph of holotype examined.]

Tufty, stream-inhabiting alga. *Thallus* fine and delicate, to firm and robust, up to 4 cm long and 120–240 µm diameter (90–170 µm at internodes), green to reddish-brown or almost black; branching irregular, sparse to frequent, acute to perpendicular. *Whorls* inconspicuous, ovoid, turnip-shaped to conical, separated except in very old thalli, open and tufty, to compact (like the hair of a clipped poodle), in degenerating plants they may be denuded; internodes 380–800 µm, long. *Thallus apices* tapering, acute; apical cell dome-shaped, 3–8 µm long, 4–8 µm diameter, L/D 0.8–1.5; subsequent axial cells firstly discoid, then globular, and finally long cylindrical; first laterals cut *c.* 3 axial cells back from apex, becoming 2-celled *c.* 8 axial cells from apex; young fascicles compact to open. *Young central axis* [100–500 µm from apical cell] consisting of axial cells 16–32 µm diameter, clothed by rhizoidal filaments 3–8 µm diameter, axial cell 3–8 times broader than rhizoidal filaments. *Mature central axis* consisting of broad axial cells, 25–130 µm diameter, clothed by rows or intertwining bundles of rhizoidal filaments, 3–4 µm diameter. *Fascicles* 2–3 per pericentral cell (plus rhizoidal filament), curved towards apex, branching 0–5 times, with 3–6 cell storeys; proximal cells globular to dome-shaped, 7–12 µm long, 4–8 µm diameter; intercalary cells at first cylindrical to slightly barrel-shaped, or cubic, finally globular to cylindric-ellipsoid, 4–14 µm long, 3–10 µm diameter; apical cell dome-shaped to somewhat ovoid, 4–12 µm long, 4–6 µm diameter; hairs absent, sparse or abundant, 5–160 µm long (but less variable in length within a single population), single-celled. *Secondary fascicles* usually frequent, similar to primary fascicles near axial cell nodes but only unicellular to few-celled away from nodes in younger thalli, eventually extending from one node to next, with or without hairs.

Monoecious or dioecious. *Carpogonial branches* relatively common in primary fascicles, borne on proximal cell of fascicle, protruding from whorl, 3–5 cells long, curved, with compact, few-celled involucral bracts not reaching trichogyne. *Carpogonia* 15–27 µm long; trichogyne inflated, and ovoid, urn-shaped, clavate, fusiform or ellipsoid, 8–16 µm long, 4–7 µm diameter. *Spermatangia* terminal on primary and secondary fascicles and on involucral bracts, spherical to obovoid, 4–6 µm long, *c.* 4 µm diameter. *Gonimoblast* 1–2 per whorl, hemispherical, protruding wart-like from primary fascicle whorl, 100–140 µm broad, 50–70 µm high; carposporangia obovoid, 7–11 µm long, 6–7 µm diameter.

'Chantransia' stage not seen. (Figs 2c-e, 3).

Distinguishing Features:

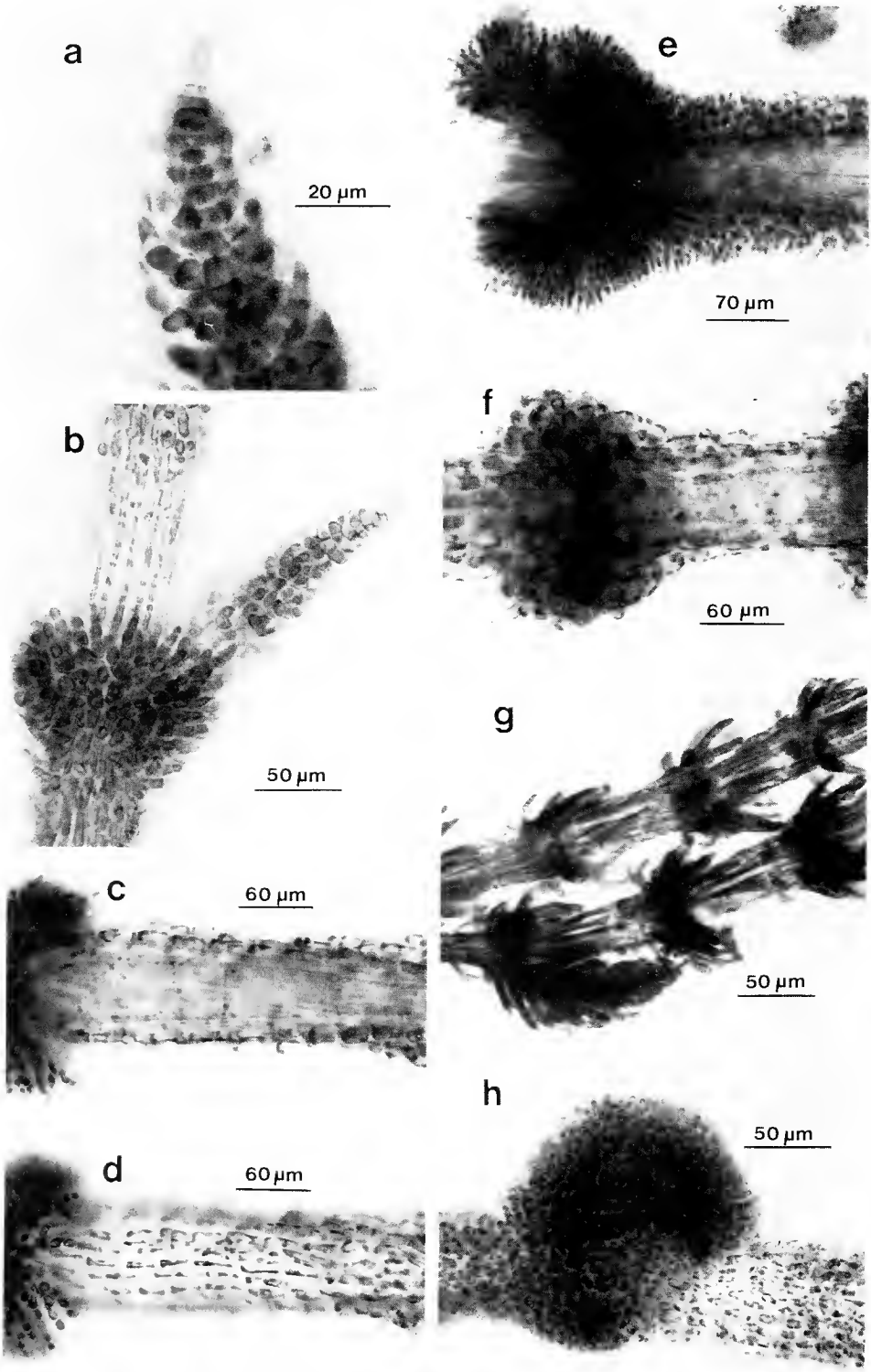
Batrachospermum atrum has tapering, acute branch apices with a protruding apical cell; whorls well-separated in young thalli (except sometimes near thallus apices); trichogynes club to urn-shaped; and gonimoblasts that protrude, usually wart-like, from the thallus. See also under distinguishing features of *B. diatyches* and *B. puiggarianum.*

Distribution & Habitat:

Africa, Asia, Australia, Europe, New Zealand, South America (Necchi 1990 & this study). Attached to rocks or plants (including other algae) in streams, less commonly in pools. Mature plants found in all months.

Specimens Examined:

The collections are divided into 3 groups based on the criteria discussed in the succeeding Taxonomic Notes. In addition to the specimens cited below, collec-


a
20 µm
b
50 µm
c
60 µm
d
60 µm
e
70 µm
f
60 µm
g
50 µm
h
50 µm

tions from Europe and New Zealand housed in BM were examined macroscopically and were all referable to *B. atrum* as delineated here.

Group (A).

Most cells in young fascicles cylindrical (L/D 1.2–3.3); mature fascicles little branched (usually > 1/2 number of cell storeys; 3–5 cell storeys, 0–2 times branching); whorls relatively open.

Australia: *Victoria* — Harris Creek, Buchan-Bruthen Road, 18.x.1984, *T.J. Entwisle 701* (MEL); Darebin Creek, Ivanhoe, 26.x.1979, *G.T. Kraft s.n.* (MEL). *New South Wales* — Gordon, -.x.1915, *A.H.S. Lucas s.n.* (NSW), 20.xi.1915, *A.H.S. Lucas s.n.* (NSW). *Queensland* — Moggill Creek, -.x.1962, *J. Pebudy s.n.* (BR); Mt Coot-tha, Brisbane, 21.iv.1983, *A.B. Cribb 963.2* (BR); Burnett Creek, 21.iv.1983, *A.B. Cribb 742.7* (BR); Violet Gorge, Carnarvon Gorge, 14.viii.1990, *A.B. Cribb. 687.53* (BR).

New Zealand: *North Island* — Tikitikiora Creek, Russell, 26.x.1938, *V.W. Lindauer 135* (AD,NSW).

Asia: *Japan* — Musashi, 27.iv.1930, *M. Higashi s.n.* (UPS).

Europe: *Denmark* — Själand, 1.vii.1945, *T. Christensen s.n.* (UPS). *France* — Vire & Caen, Brittany, -.iii/vi.-, *Chauvin s.n.* (MEL), *s.d., Chauvin s.n.* (MEL); Vire, Brittany, *s.d., Lenormand 326* (MEL), *s.d., Anon* [ex Herb. Lenormand] (MEL,UPS); environs de Paris, 2.vi.1949, *E. Bornet s.n.* (UPS). *Germany* — Husbye, *s.d., L. Hansen s.n.* (MEL), *s.d., Suhr s.n.* (MEL); Erfurt, 25.ix.1835, *E. Caemmerer s.n.* (MEL). *Sweden* — Höör, 19.iv.1896, *H.G. Simmons s.n.* (UPS); 26.iv.1896, *O.R. Holmberg s.n.* (UPS); 29.vii.1909, *H. Kylin s.n.* (UPS); Väddö, 1.x.1934, *G. Israelson s.n.* (UPS); Bävc, Eriksfors, 21.vi.1990, *H. Kylin s.n.* (UPS); Bosjökloster, 30.vii.1909, *H. Kylin s.n.* (UPS).

Group (B).

Most cells in young fascicles rounded or barrel-shaped (L/D 0.8–2.0); mature fascicles richly branched (> 1/2 number of cell storeys; 3–6 cell storeys, 2–5 times branching); whorls compact.

Australia: *Victoria* — Tidal River, Wilsons Promontory, 8.iv.1981, *T.J. Entwisle 39* (MEL), 24.vi.1983, *T.J. Entwisle 271* (MEL), 16.iv.1990, *T.J. Entwisle 1658* (MEL); McKenzies River, Zumsteins, 3.v.1981, *G.T. Kraft & T.J. Entwisle 48* (MEL), 3.v.1981, *G.T. Kraft & T.J. Entwisle 49* (MEL); Troopers Creek, Grampians, 18.v.1981, *P. Gabrielson & M. Barson s.n.* (MEL); Moor Moora Creek, Grampians, 18.ix.1990, *Entwisle 1668* (MEL); Masons Falls, Running Creek, Kinglake National Park, 7.x.1987, *T.J. Entwisle 1410* (MEL), 28.x.1987, *T.J. Entwisle 1428* (MEL); Pheasant Creek, Flowerdale-Kinglake West Road, 24.i.1983, *T.J. Entwisle 503* (MEL); W Tree Creek, Wulgulmerang-Buchen Road, *J.H. Ross & T.J. Entwisle 1813* (MEL). *New South Wales* — Lyrebird Creek, Barren Grounds Nature Reserve, via Robertson, -.viii.1984, *A. Hardham & B. Gunning s.n.* (MEL), 11.xi.1988, *R.A. Andersen & T.J. Entwisle 1566* (MEL); Dargans Creek, Clarence, Blue Mountains, iv.1918, *A.H.S. Lucas s.n.* (HO,NSW,UPS), 7.ii.1991, *T.J. Entwisle & P.M. McCarthy* (MEL). *South Australia* — Delamere, 21.iii.1987, *B.J. Brock s.n.* (AD, MEL); Wilpena Pound, Flinders Ranges, 24.xii.1965, *V. May s.n.* (NSW). *Queensland* — Pullenvale Crcek, 12.x.1967, *J. Pebudy* (BRI). *Tasmania* — creek into Lake Fortuna, Western Arthurs, 8.xi.1982, *P.R. Robins & T.J. Entwisle 103* (MEL); Cradle Mountain, *s.d., L. Rodway s.n.* (HO); Launceston, xii.1844, *R.C. Gunn 1826* (HO, NSW); Pool, Mt Field Plateau, xii.1910, *L. Rodway s.n.* (HO, NSW); creek into Lake Dove, 13.xii.1973, *A.B. Cribb 773.3 p.p.* (BRI).

New Zealand: *South Island* — tributary of Arthur River, Milford Sound, -.i.1971, *V. Stout (S1)* (MEL); tributary of Cleddau River, Milford Sound, -.i.1971, *V. Stout (S3)* (MEL); Island Stream, Oamaru, -.iv.1969, *M. Taylor (T1)* (MEL).

Europe: *England* — Yarmouth, *s.d., Turner s.n.* (MEL). *France* — Deux-Ponts, 17.vii.1844, *Gümbel 595* (MEL). *Germany* — Ausacker Mill, 30.iii.1832, *L. Hansen s.n.* (MEL); Würzburg, *s.d., Anon.* (MEL); Husbye, *s.d., Suhr s.n.* (MEL). *Sweden* — Tyringe, 2.viii.1909, *H. Kylin s.n.* (UPS).

Group (C).

Intermediate between group (A) and group (B).

Australia: *Victoria* — Swifts Creek, Eastern Victoria, 17.x.1984, *T.J. Entwisle 695* (MEL); Swifts Creek, Swifts Creek Township, 28.x.1990, *J.H. Ross & T.J. Entwisle 1797* (MEL); Murrindal River, Wulgulmerang-Buchan Road, 29.x.1990, *J.H. Ross & T.J. Entwisle 1814* (MEL); Splitters Creek, near Wulgulmerang, 29.x.1990, *J.H. Ross & T.J. Entwisle 1810* (MEL): young fascicles cells short cylindrical (L/D 1.6–2.0), mature whorls very open with short, little branched fascicles (cell storeys 3–4, branches 1–2), and apices crowded. *Queensland* — Lower dry Creek, Kroombit Tops, 11.xii.1983, *A.B. Cribb 985.1* (BRI): as with Victorian specimens.

Europe: *France* — Vire, Brittany, *s.d., Lenormand 327* (MEL): young fascicle cells short cylindrical to globular (L/D 1.0–1.8), mature whorl structure difficult to decipher (cell storeys *c.* 5, branches *c.* 2); Bordeaux & Brittany, *s.d., Bory de St-Vincent 111* (MEL): young fascicle cells short cylindrical (L/D 1.2–2.0), mature whorl structure difficult to decipher (cell storeys *c.* 4, branches *c.* 1–3).

Fig. 3. *Batrachospermum atrum*. a — apex of thallus with protruding apical cell and immediate derivatives (*Entwisle 1410*). b — whorl of fascicles and young indeterminate lateral (*Entwisle 76*). c,d — internode of thallus at two different foci showing axial cell (c) and rhizoidal filaments (d) (*Hardham & Gunning s.n.*). e — relatively open whorl (*Hardham & Gunning s.n.*). f — relatively compact whorl (*Entwisle 1566*). g — open, loose whorl with long, cylindrical fascicle cells (*Lindauer 135*). h — compact whorl and protruding gonimoblast (*Entwisle 1566*).

Taxonomic Notes:

The apices of all plants of *B. atrum* examined in the current study exhibited the following developmental pattern: the first laterals were cut off about 3–4 cells back from the apex and became 2-celled within the next 4 axial cells. The laterals initially consisted of cylindrical or globular cells with a dome-shaped to ovoid distal cell. In older fascicles, the cells were more rounded, eventually becoming barrel-shaped to globose. Hairs were often present, ranging in length from shorter than the apical cell to over 120 μm long. These observations concur with those of Necchi (1990) for *B. atrum*.

There was, however, considerable variation in the gross morphology of these plants. Some plants were quite distinctive in having one or more of the following features:

i) profuse thallus branching,
ii) thallus apices crowded by young fascicles,
iii) globular, more compact shaped whorls, and
iv) blunt — but still acute — rather than tapering thallus apices (apparently due to the shorter internodes).

There was no clear disjunction between any of these variants and plants with the more typical morphologies due to the presence of intermediate populations or even seasonal variation within populations.

The development and morphology of determinant laterals allowed two broad groupings to be recognized:

i) with intercalary cells in young whorls cylindrical, and fascicles always little branched (group A), and
ii) with intercalary cells in young whorls barrel-shaped or globular, and fascicles more or less richly branched (group B).

The first group typically had relatively long, brush-like whorls while the latter had more compact whorls. Once again, however, these differences could not be adequately quantified (or described) and a number of intermediate populations exist (Fig. 4). The distributional ranges of the two groups overlap considerably and there does not appear to be any obvious correlation between habitat and morphology (although water quality and stream velocity or turbulence could conceivably effect fascicle development; see also notes under *B. nothogeae* at end of paper). Overmature specimens from a population usually referable to group (B) can resemble group (A) specimens due to the denudation of outer fascicle cells (exposing the more swollen inner cells). Because of the lack of a clear disjunction, these two groups are not given any taxonomic recognition. However, to facilitate any re-examination of this variation within *B. atrum* (and to promote the search for ecological and geographical variation), the specimens examined have been separated into three groups (including intermediate morphologies) based on the above criteria. New, probably non-morphological features, will be necessary to make any meaningful cleavage through the *B. atrum* assemblage.

Historical Remarks:

In Georgian England, spring was heralded by the appearance of 'Slippery Pearl'd Black Hair' [or 'Black Beaded Conferva'] in select brooks and limpid rivulets (Dillenius 1741, Hudson 1778, Smith & Sowerby 1800, Dillwyn 1802). Although initially pale-green and delicate, by winter it darkened in colour and became quite bushy (Dillwyn 1802); late season plants were almost black, prompting Hudson (1778) to name it *Conferva atra*. Magnification of the thallus revealed minute mealy fibres at regular intervals, giving it a jointed appearance (Dillwyn 1802), and it was obviously related to *Conferva gelatinosa*, the 'Frog-spawn Conferva' (Smith & Sowerby 1800), but the whorls of laterals were distinctly smaller.

In 1797, Roth described the genus *Batrachospermum* to include a handful of algal collections, one of them carrying the Linnaean name *Conferva gelatinosa* (Linnaeus 1753). *Batrachospermum gelatinosum* (Linnaeus) de Candolle was not

formally described until 5 years later (de Candolle 1802), but is an earlier synonym for the widely used *B. moniliforme* Roth (1800).

In the early nineteenth century, many taxa were described in *Batrachospermum* by Carl Agardh, Bory St-Vincent, Kützing and Montagne, but the epithet '*atra*' remained largely ignored until Harvey (1841) transferred *Conferva atra* to *Batrachospermum*. Prior to 1841, a swag of names appeared in the literature for the 'Slippery Pearl'd Black Hair'. The nomenclature generally followed nationalistic (or linguistic) lines, with the English, the French and the Germans each devising their own names for this distinctive taxon.

On the continent, Bory de St-Vincent (1808) described 3 species of *Lemanea* from France which were later (Bory de St-Vincent 1823) transferred to the subgenus *Lemanines* of *Batrachospermum* (a subgenus equivalent to Sirodot's section *Sétacés* in circumscription). Sirodot (1884) reduced the three species to one,

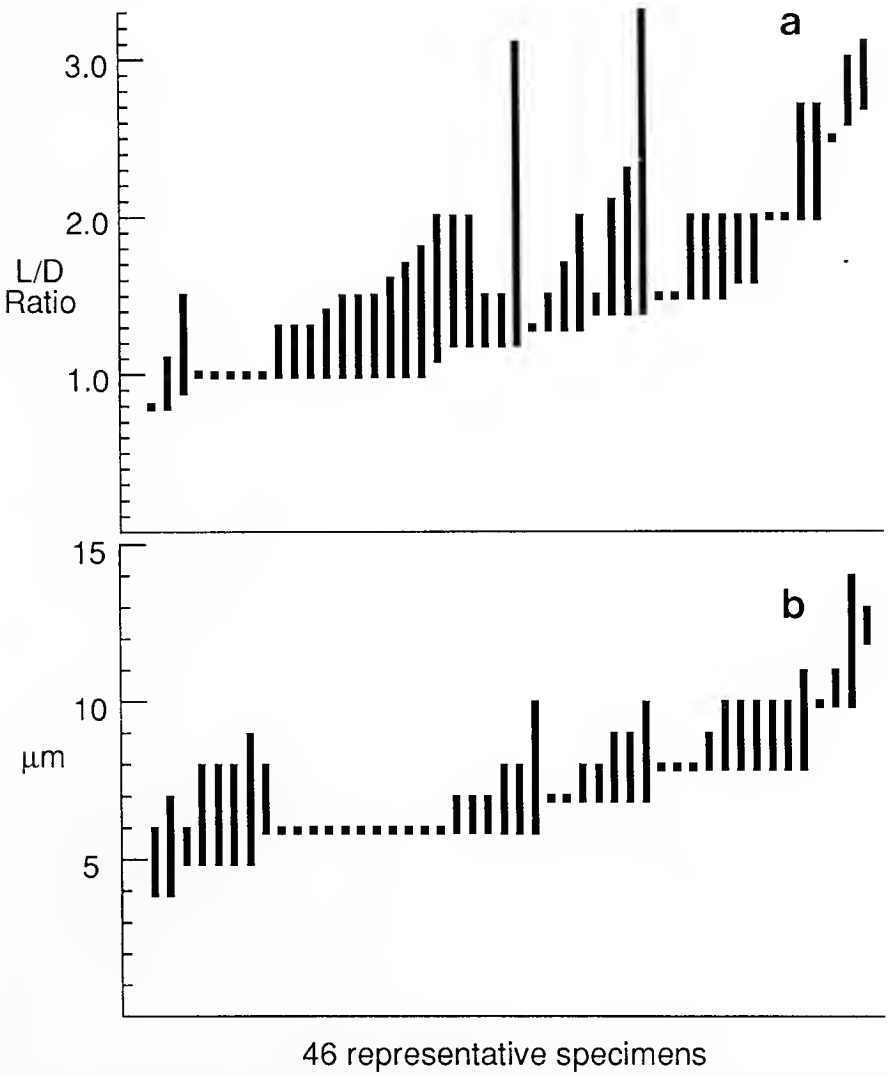


Fig. 4. Fascicle cell measurements of *Batrachospermum atrum*. a — intercalary cell length-to-diameter ratio in young fascicles. b — intercalary cell length in young fascicles (µm). Representative specimens taken at random from those examined.

Batrachospermum dillenii (Bory de St-Vincent) Bory de St-Vincent (with *B. atrum* as a synonym) but maintained a variety 'a. *tenuissimum*' for slender plants with poorly developed whorls and fewer secondary fascicles. A second species was added to the section *Sétacés*, *B. gallaei* Sirodot, which had spermatangia and carpogonia borne on separate plants and occasional gonimoblasts arising from rhizoidal filaments.

In the German literature, a range of varietal names exist for taxa equivalent to *B. atrum*: Carol Agardh (1817) used '*Batrachospermum moniliforme* β *detersum*' for setaceous species of *Batrachospermum*, whereas Kützing (1849) used Agardh's epithet as well as '*B. vagum* β *tenuissimum*' (based on *Conferva atra sensu* Smith & Sowerby 1800 = *C. atra* Hudson) and '*B. vagum* γ *detersum* (based at least partly on *Lemanea sertularina* = *B. dillenii* Sirodot). Rabenhorst (1868) introduced the names '*B. moniliforme* i. *atrum*' (based on *B. atrum*) and '*B. vagum* e. *dillenii*' (based on *B. dillenii*) for two apparently different plants. Other synonyms exist in the genus *Torularia* Bonnemaison (= *Batrachospermum*) as well as *Batrachospermum* (e.g. see De Toni 1897, p. 57).

The English, following Harvey (1841), used *B. atrum* (e.g. Cooke 1882–4, Hassall 1845), in the case of Cooke (1882–4) with the addition of a curious varietal name — '*B. atrum* var. *dillenii*'. Following Sirodot (1884), however, the names *B. dillenii* and *B. gallaei* (the former monoecious, the latter dioecious) were used widely throughout the world (e.g. Pascher & Schiller 1925) until Israelson (1942) resurrected *B. atrum* and proposed the synonymy of both Sirodot's setaceous species. Recently, Necchi (1990) has also referred the African alga described as *B. angolense* W. West & G.S. West (1897) to *B. atrum*.

A number of taxa apparently distinct from *B. atrum* have been recognized among the setaceous *Batrachospermum* species, and Necchi (1990) discusses the affinities of most of these. *Batrachospermum puiggarianum* is the only other setaceous taxon retained by Necchi (1990), although *B. orthostichum*, originally included in the section *Setacea*, is transferred by Necchi to the section *Turficola* due to the presence of indeterminate as well as determinate gonimoblast filaments.

3. **Batrachospermum puiggarianum** Grunow in Wittrock & Nordstedt, *Algae Exsic.* 11: 1, no. 501 (1883). *Batrachospermum atrum* var. *puiggarianum* (Grunow) Necchi, *Bolm Bot.* 11: 25 (1989).

Heterotypic Synonyms: *Batrachospermum schwackeanum* Möbius, *Ber. dt. bot. Ges.* 10: 20, pl. 1 figs 1–8. (1892).

Batrachospermum nigrescens W. West & G.S. West, *J. Bot.* 35: 2 (1897). *Sirodotia nigrescens* (W. West & G.S. West) Skuja, *Bol. Soc. brot.* 34: 54 (1960).]

Typus: Apiaí, São Paulo, Brazil. Coll. *Y.I. Piggari s.n.*, some time prior to 1883 (S). [Type material not examined]

Tufty, stream-inhabiting alga. *Thallus* rigid, up to 6 cm long and 80–300 μm diameter; branching irregular, frequent, acute to perpendicular. *Whorls* inconspicuous, obconical or pear-shaped, separated or contiguous, compact; internodes 200–1000 μm long. *Thallus apices* long tapering, acute; apical cell dome-shaped, *c.* 6 μm long, *c.* 7 μm diameter, L/D *c.* 1; subsequent axial cells globular, and finally cylindrical; first laterals cut *c.* 3 axial cells back from apex, becoming 2-celled *c.* 10 or more axial cells from apex; young fascicles indiscernible, appearing as packets of globular cells tightly corticating each node. *Young central axis* [100–500 μm from apical cell] consisting of axial cells *c.* 8–25 μm diameter, clothed by rhizoidal filaments *c.* 6 μm diameter and resembling the fascicles, axial cell *c.* 3–4 times broader than rhizoidal filaments. *Mature central axis* consisting of broad axial cells, *c.* 40–80 μm diameter, clothed by rows of rhizoidal filaments, *c.* 4 μm diameter. *Fascicles* 2 per pericentral cell (plus rhizoidal filament), branching 1–2(-3) times, with 2–5 cell storeys; cells 7–18 μm long, 6–12 μm diameter, proximal

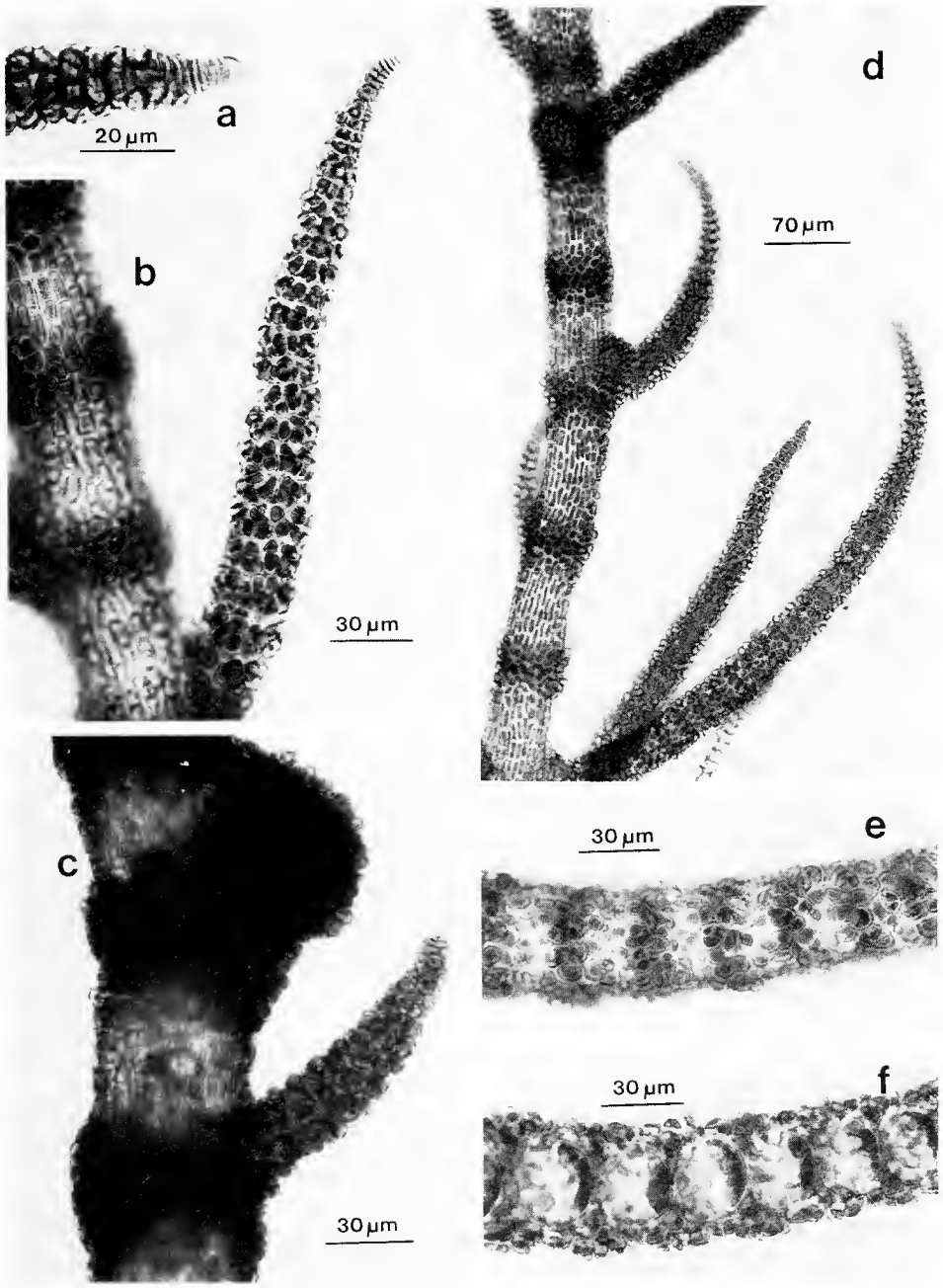


Fig. 5. *Batrachospermum puiggarianum* (*Paula s.n.*). a — apex of thallus with protruding apical cell and immediate derivatives. b — whorl structure in young indeterminate lateral and mature axis. c — gonimoblast protruding from top whorl and indeterminate lateral arising from bottom whorl. d — thallus habit showing appearance. e,f — internode of thallus at two different foci showing rhizoidal filaments (e) and young rhizoidal filaments and compact fascicles (f).

and intercalary cells finally barrel-shaped or cylindrical, apical cell conical; hairs absent to abundant, long. *Secondary fascicles* frequent, similar to primary fascicles near axial cell nodes but only unicellular to few-celled away from nodes in younger thalli, eventually extending from one node to next.

Monoecious or dioecious. *Carpogonial branches* relatively common in primary fascicles, borne on pericentral cell or proximal cell of fascicle, protruding from whorl, 1–3 cells long, straight or curved, with compact, few-celled involucral bracts not reaching trichogyne. *Carpogonia* 8–32 µm long; trichogyne club-shaped or elliptic, 5–9 µm diameter. *Spermatangia* terminal, rarely subterminal, on primary and secondary fascicles, spherical to obovoid, 4–7 µm diameter. *Gonimoblast* 1–2(-3) per whorl, hemispherical, protruding wart-like from primary fascicle whorl, 90–220 µm broad, 50–130 µm high; carposporangia obovoid to elliptic, 8–13 µm long, 6–11 µm diameter. [Description adapted from Necchi 1990, pp. 172–173, with additional information from specimen examined] (Figs 5, 6)

Diagnostic Features:

B. puiggarianum differs from *B. atrum* in having thallus apices with very compact whorls which appear as clusters of cells tightly corticating the node rather than as branched fascicles. Subsequent division of the primary fascicle initials seems to occur at least 10 axial cells from the apex of the thallus.

Distribution & Habitat:

Angola (Africa), and Argentine, Brazil and Uruguai (South America). Attached to rocks or plants in moderate to fast flowing streams (Necchi 1990). Mature plants found throughout the year (Necchi 1990).

Specimen Examined:

Brazil — Monte Mor, Capivari Mirim River, 27.vii.1975, *E.J. Paula* (SP, MEL).

Taxonomic Notes:

Batrachospermum puiggarianum has been distinguished from *B. atrum* primarily on the basis of its very compact whorls, in which individual fascicles cannot be discerned. In addition to whorl compactness, the illustrations of *B. puiggarianum* by Necchi (1990) show an apex with globular lateral initials, no 2-celled laterals until some 13 cells proximal to the apex, and an indiscernible fascicle structure. Although Starmach (1977) used the absence of secondary laterals to characterize *B. puiggarianum*, Necchi (1990) found secondary laterals to be abundant in the material he observed (including the holotype).

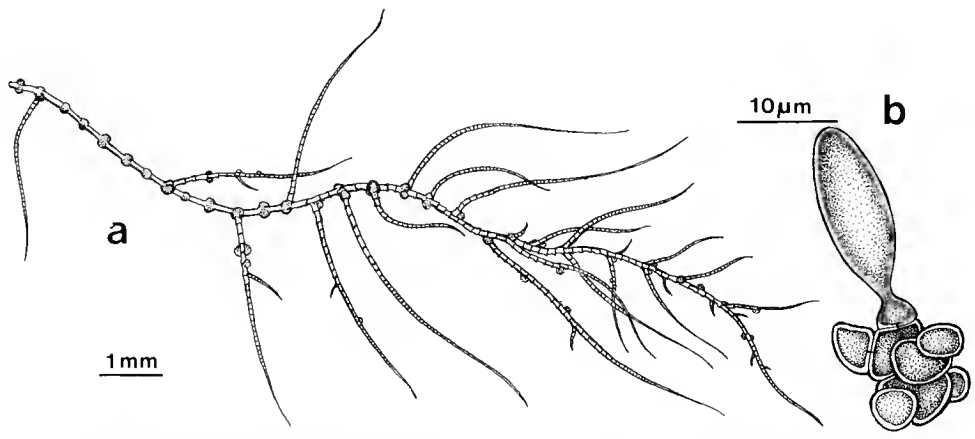


Fig. 6. *Batrachospermum puiggarianum* (*Paula s.n.*). a — habit. b — carpogonial branch.

Observations on Brazilian material of *B. puiggarianum* made during the current study have confirmed the findings of Necchi (1990) that this taxon is indeed distinct from *B. atrum*. The young thallus apices are quite different: with their tightly corticating fascicles (the structure of which is hardly discernible), they resemble superficially species of Lemaneaceae or even *Ceramium* (Rhodophyta, Ceramiaceae) more than *Batrachospermum*. In the young whorls, the fascicle cells are mostly globular and seldom longer than wide. Although some specimens of *B. atrum* with compact whorls may resemble this species, an examination of young, healthy thallus apices should be sufficient to correctly separate them.

SYNONYMY & ALLIED TAXA

In an unpublished list of *Batrachospermum* species (held at UPS), Skuja lists the following published and unpublished species in the section *Setacea* (with his comments in square brackets): *B. dillenii* [dioecious], *B. nothogeae*, *B. gallaei* [monoecious], *B. gallaei* var. *longipilum* [New Zealand], *B. protimum nom. ms.* [Liberia; monoecious], *B. annulatum nom. ms.* [U.S.A.; monoecious], *B. africanum* Rabenhorst [?*Sirodotia*; dioecious; Africa], *B. puiggarianum* [Brazil], *B. schwackeanum* [monoecious], *B. orthostichum* [Brazil]; monoecious], *B. patens* Suhr [S. Africa; monoecious] and *B. sirodotioides* n. sp. [monoecious].

I have not seen any material of, or published reference to, '*B. protimum*', '*B. annulatum*' and '*B. sirodotioides*', and their status must await further study. The proposed synonymy by Necchi (1990) of *B. schwackeanum* (and *B. nigrescens*) with *B. puiggarianum*, and *B. angolense* with *B. atrum*, was based on an examination of type materials and his familiarity with the Batrachospermaceous flora of Brazil, and his judgements are accepted here. Israelson (1942) argued convincingly for the synonymy of *B. gallaei* and *B. dillenii* with *B. atrum* (see also Historical Remarks under *B. atrum*). The other taxa are considered below.

B. africanum Rabenhorst, *Allg. Deutsche Naturhist. Zeitung n.s.* 1: 281 (1855).

An isotype of this species at MEL includes a mixture of two *Batrachospermum* species, one probably referable to section *Sirodotia* (although no reproductive structures were observed) and the second to *B. puiggarianum* or *B. atrum*. Although the mature whorls of the latter plants were similar to those of *B. puiggarianum*, the young thallus apices *seemed* to be more like those of *B. atrum*. Due to the lack of good apical material, a definitive determination of the latter plants cannot be made. In any case, since Rabenhorst (1855) interpreted the two taxa on this sheet as growth forms of a single species, the application of the name *B. africanum* is unclear. Consequently, *B. africanum* Rabenhorst remains as a species *inc. sed.*

B. gallaei var. *longipilum* Skuja *nom. nud.*

Skuja described this variety (Skuja-Tyler corr., 19.ii.1970) as having rather undeveloped laterals and conspicuous, numerous, long hairs. This manuscript name originally was coined for 2 collections from New Zealand: Avon River, Christchurch (*Laing 1101*) and Te Henga (*L. Cranwell*, 7.vii.1931). From Skuja's illustrations of these species (Figs 7, 8), they are clearly referable to *B. atrum* as circumscribed here.

Hair formation in algae is often environmentally controlled: e.g. by light regime (Dixon 1973; for Floridiophycidae) or nutrient status of the water (e.g. *Stigeoclonium* produces profuse, long hairs in nitrogen and phosphorus deficient media and no hairs in nutrient enriched media; pers. obs.). Hair abundance and length were extremely variable in the material of *B. atrum* examined and are unlikely to indicate more than an ecomorph [corroborating the findings of Necchi (1988) for various *Batrachospermum* species from Brazil].

Five additional New Zealand collections were later referred to this variety: Cowans (*L.M. Cranwell*, 17.ix.1932); Anawhata (*L.M. Cranwell 1932/1*, 17.vii.1932); Maheno (*M. Taylor*, 16.iii.1969); Tucker Point, Auckland

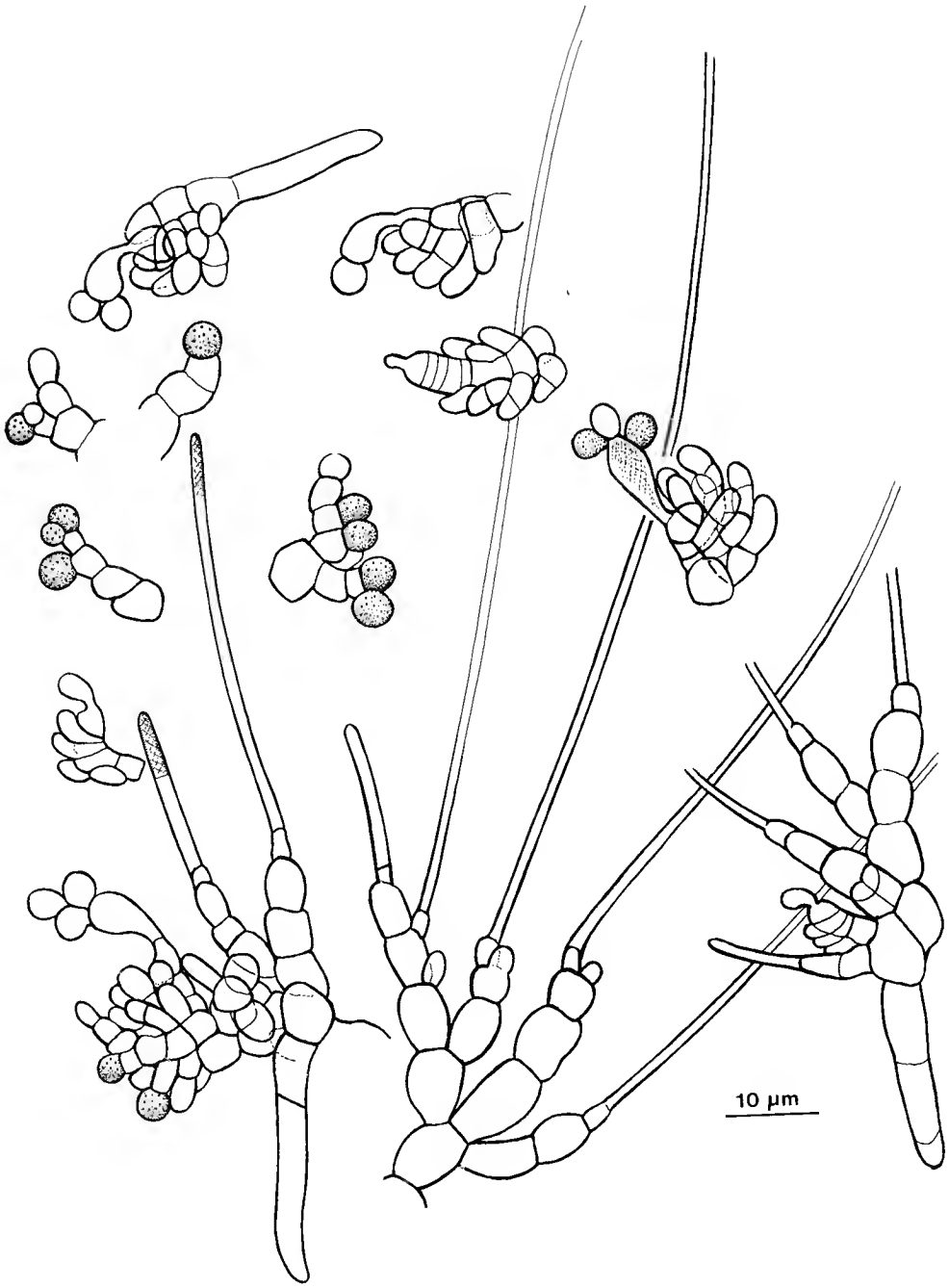


Fig. 7. *Batrachospermum gallaei* var. *longipilum* Skuja *nom. nud.*. Unpublished sketches by H. Skuja (redrawn by Anita Barley) from material collected at Te Henga, New Zealand (*Cranwell s.n.*). They show spermatangium, carpogonial branches and fascicles terminated by long hairs. This material is referable to *B. atrum* as circumscribed in this paper.

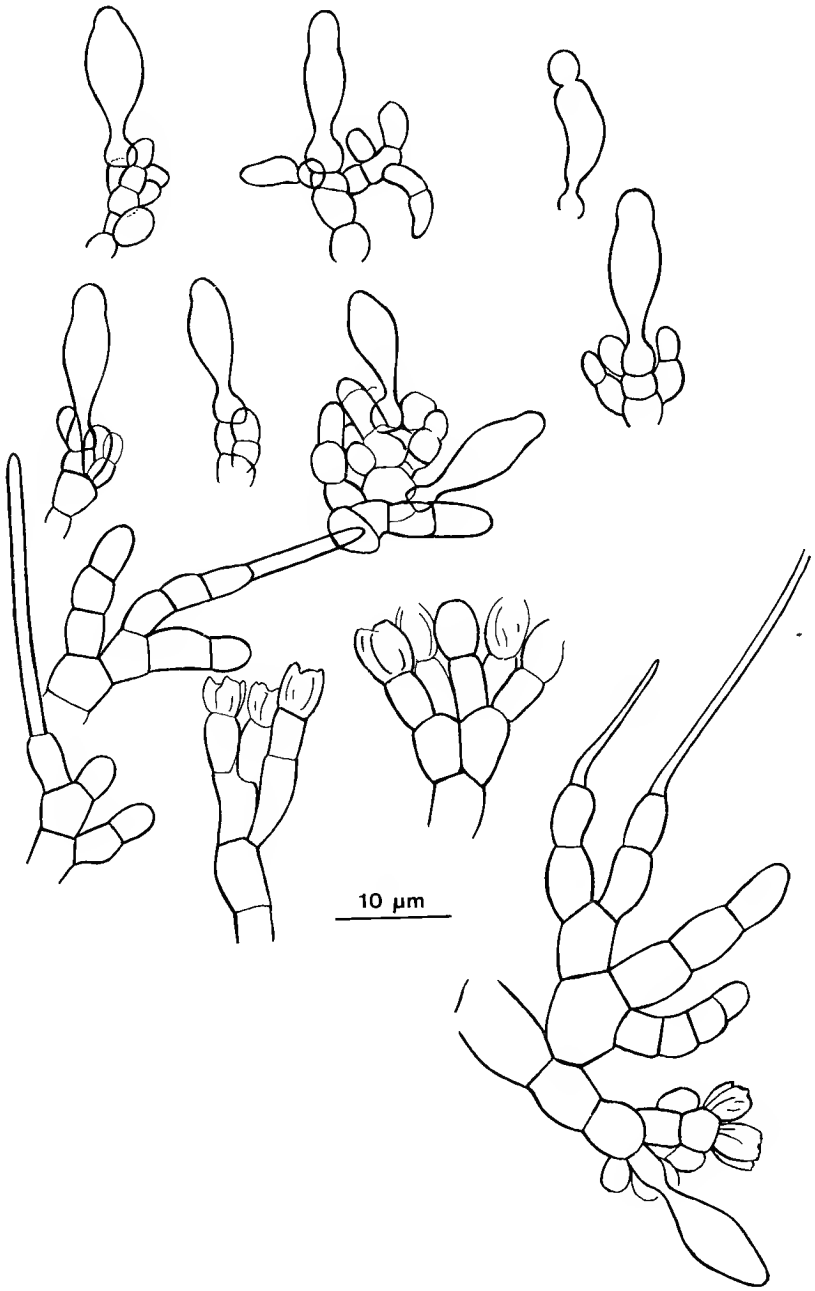


Fig. 8. *Batrachospermum gallaei* var. *longipilum* Skuja *nom. nud.* Unpublished sketches by H. Skuja (redrawn by Anita Barley) from material collected from the Avon River, Christchurch, New Zealand (*Laing 1101*). They show carpogonial branches, empty spermatangium and hairs terminating fascicle cells. This material is referable to *B. atrum* as circumscribed in this paper.

Island (*K. Wise*, 19.i.1963: 'probably var. *longipilum*'); and Torbay Falls, Auckland (*M. Seager*, 24.x.1953). [A further collection from Tikitikiora Creek, Bay of Islands (*V.W. Lindauer 135*, 26.x.1938) in AD and NSW is labelled as *B. gallaei* var. *longipilum* but does not have any hairs and was not determined by Skuja.]

Skuja also identified three Tasmanian collections as *B. gallaei* var. *longipilum*: bog pool, Mt Wellington (*Tyler 660609/4*); North Lake, Mt Picton (*Tyler 690201/1*); and Creek No. 2, into Lake Pedder (*Tyler 691126/1*). Photomicrographs of a later collection from the bog pool on Mt Wellington show a setaceous plant with compact whorls of discernible structure, rounded fascicle cells and abundant, very long hairs.

Skuja described *B. dillenii* as a dioecious alga with more strongly developed laterals and shorter fewer hairs than '*B. gallaei* var. *longipilum*'. This probably allies *B. dillenii* with *B. atrum* group (A) as defined above. [His interpretation of the Queensland material referred to *B. dillenii*, based on an examination of published illustrations (Möbius 1895, pl. 1 figs 1–7; reproduced in Bailey 1895), is that it is probably misidentified].

B. nothogeae Skuja *nom. nud.*

This manuscript name was devised by Skuja for two collections from the Falkland Islands and New South Wales, Australia (see Historical Remarks under *B. diatyches*). A third population, from Lake Pedder (here described as *B. diatyches*) in Tasmania, Australia, was viewed as a possible variety of this species [Tyler-Skuja corr., 23.iv.1968: annotation on letter by Skuja reads: '660303/2 — *Batrachosp. nothogeae* Skuja in Mspt. *var.*'].

The Falkland Islands collection [William Stanleys Haven, 1850s, *Lechler s.n.* (UPS)] has very compact, reduced whorls whose structure can be barely discerned, and the fascicles are certainly not like those of *B. diatyches*. There are few young apices in the herbarium material examined, but one observed was tapering with a protruding apical cell. This population may be referable to either *B. atrum* or *B. puiggarianum*.

The New South Wales alga, from Clarence in the Blue Mountains (-.iv.1918, *A.H.S. Lucas s.n.*; 7.ii.1991, *T.J. Entwisle & P.M. McCarthy*), has relatively diminutive whorls, but still falls within the broadly circumscribed *B. atrum* accepted here. Variants similar to those from Clarence also occur in other acidic, electrolyte poor, sandstone areas near Sydney and Woollongong. Elsewhere in Australia and overseas, *Batrachospermum atrum* is mostly found in alkaline, hard-water (but relatively pristine) streams. The sandstone populations of *B. atrum* appear to have distinctive ecological requirements, which may support their recognition as a distinct taxon should good diagnostic characters be found at some later date.

The Lake Pedder material is clearly distinct from the other two collections, but due to Skuja's obvious intention that the New South Wales and Falkland Islands algae represent what he perceived as '*B. nothogeae*', that name is unsuitable for the new taxon described in this paper. '*B. nothogeae*', therefore, will remain a *nomen nudum* unless later revisionists wish to revive Skuja's taxon (and use his epithet).

B. orthostichum Skuja, *Hedwigia* 71: 84, pl. 2 figs 1–15 (1931).

Two species in the section *Turficola*, *B. orthostichum* and *B. keratophytum* (*sensu* Necchi 1990), can have reduced whorls but are quite different from *B. atrum*. *Batrachospermum orthostichum*, although producing *atrum*-like fascicles, has relatively well-developed, confluent whorls. It also has club-shaped thallus apices and both determinate and indeterminate gonimoblast filaments (Necchi 1990 and pers. obs. on Brazilian material from SP).

B. patens Suhr, *Flora* 23: 296–297 (1840).

This species was based on a collection from Cape Kroemsrivier, South Africa (1839, *Drège*), part of which is housed at MEL. The thallus apices are rounded, the

fascicles curved, and with most cells short-cylindrical to barrel-shaped and proximal cells long-cylindrical. The globular gonimoblast protrudes from the whorl, but is like a denser and broader vegetative whorl rather than a 'wart-like' protuberance. Some gonimoblast filaments extend along the internode and are presumably indeterminate. The MEL plants closely resemble *B. keratophytum* as delineated by Necchi (1990), a taxon conceived somewhat differently by Entwisle (1984, 1989). The North American interpretation of this taxon appears to be different again (based on herbarium material held in MEL), so that the circumscription of *B. keratophytum* and related taxa, such as *B. patens*, needs to be critically assessed based on the re-examination of available types. That analysis is beyond the scope of this study.

B. tenuissimum Bory de St-Vincent, *Dict. class. hist. nat.* 227 (1823). *B. dillenii* var. *tenuissimum* (Bory de St-Vincent) Sirodot, *Batrachospermes* 256, pl. 20 figs 3,4, pl. 21 figs 13–16 (1884). *Lemanea batrachospermosa* Bory de St-Vincent, *Annls. Mus. natl. Hist. nat.* 12: 188, pl. 25, figs 3,4 (1808).

Most French collections referred to this species belong to *B. atrum* group (A), and this informal grouping may be the taxon Bory de St-Vincent perceived as distinct from *B. dillenii* [although some French collections referable to *B. atrum* group (A) from the same region have been identified as *B. dillenii sensu str.*]. Sirodot (1884, p. 256) found both slender growth forms ('var. *tenuissimum*') and broad growth forms ('typical variety') in a mountain spring. He surmised that the slender thalli were produced in shaded habitats with low water levels. Although Sirodot accepted Bory de St-Vincent's taxon at the varietal level, he appeared to be convinced that it was no more than a growth form of *B. dillenii*.

MONOPHYLY

Whether or not the species defined here are monophyletic, cannot be determined at this stage. The major developmental differences between *B. diatyches* and the other two species — such as apical cell size and disposition, and the shape and development of determinate laterals — suggest that this may in fact not be the case. There is certainly no evidence to support the homology of reduced whorls in the three taxa.

The mature thalli of the setaceous *Batrachospermum* species have determinate laterals which are unilaterally branched, curved, and consisting of predominantly cylindrical or barrel-shaped cells throughout. These 'audouinelloid-like' fascicles (Necchi 1988) closely resemble the prostrate phase ('Chantransia') found in almost all *Batrachospermum* life histories. The mature thalli of most, but not all, other *Batrachospermum* species have freely branched laterals consisting of rounded, ovoid or bone-shaped cells. Since there are no 'Chantransia' phases with nonaudouinelloid-like cells and it could be argued that the audounelloid-like morphology is the more general state in the genus. The problem with this argument lies in the homology of the characters: are audouinelloid-like laterals in the macroscopic phase homologous to the filaments of the 'Chantransia' phase? If they are homologous, the setaceous *Batrachospermum* are defined by a plesiomorphic character and are an unnatural (paraphyletic) group. It they are not homologous, we do not know whether the group is monophyletic or paraphyletic. It seems less likely that dissimilar cell morphologies between the life phases of an ancestral taxa would converge to produce what now appear to be a homologous states (but see Gabrielson & Garbary 1987, who conclude that the resolution of ancestral states from heteromorphic vs isomorphic generations is irresolvable). That all 'audouinelloid-like' cells in *Batrachospermum* are homologous and plesiomorphic seems, to me, to be a reasonable, and parsimonious, assumption. This would imply that the three setaceous *Batrachospermum* species do not form a monophyletic group since they share no apomorphies.

In any case, due to the phenetic similarities between *B. atrum*, *B. puiggarianum* and *B. diatyches*, a detailed comparison of the group has been necessary before any taxonomic entities could be clearly delimited. Later analyses may well show that the setaceous taxa considered in this paper do not share a common ancestor unique to themselves, even though as a morphological group the three taxa are best defined in reference to one another.

ACKNOWLEDGEMENTS

Thanks to Anita Barley (National Herbarium of Victoria) for original drawings and for accurately reproducing the unpublished sketches of Heinrichs Skuja; to Gerry Kraft (University of Melbourne) and Orlando Necchi Jr (Universidade Estadual Paulista) for comments on the manuscript; to Peter Tyler (University of Tasmania) for correspondence and collections; to Neville Walsh (National Herbarium of Melbourne) for Latin diagnoses; to the directors and curators of BRI, NSW, BM (particularly Jenny Moore) and HO for provision of loans and information; to Bill Woelkerling and the Department of Botany, La Trobe University for access to microscope facilities; to Orlando Necchi Jr (as above) who, in 1988 (while attending the Phycological Congress in Melbourne), remarked on the similarity between some of Australian plants I had referred to *B. atrum* (in Entwisle & Kraft 1984) and *B. puiggarianum*, thus provoking me into reexamining this group, and also for his kind donation of wet-preserved material of *B. puiggarianum*, *B. atrum* and *B. orthostichum* from Brazil; and to Torbjörn Willén for tremendous help in getting access to the correspondence and notes of Heinrichs Skuja.

REFERENCES

Agardh, C.A. (1817). 'Synopsis algarum Scandinaviae adjecta despositione universali algarum'. (Lund.)

Bory de St-Vincent, J. B. (1808). Sur le genre *Batrachosperma*, de la famille des Conferves. *Annls. Mus. natl. Hist. nat.* 12: 310–332, pl. 24–26.

Bory de St-Vincent, J. B. (1823). 'Dictionnaire Classique d'Histoire Naturelle' Vol. 3. (Paris.)

Candolle, A.P. de (1802). Rapport sur les conferves, fait à la société philomoatique. *J. Phys. Chim. Hist. nat.* 54: 17–21.

Cooke, M.C. (1882–4). 'British Fresh-water Algae'. 2 vols (Williams & Norgate: Edinburgh.)

De Toni. J.B. (1897). 'Sylloge Algarum omnium hucusque cognitarum'. Vol. 4(1). Florideae. (Privately published: Padova.)

Dillenius, J.J. (1741). 'Historia muscorum'. (Sheldonian Theatre: Oxford.)

Dillwyn, L.W. (1802). 'British Confervae'. Fasc. 1. (W. Phillips: London.)

Dixon, P.S. (1973). 'Biology of the Rhodophyta'. (T. & A. Constable: Edinburgh.)

Entwisle, T.J. & Kraft, G. T. (1984). Survey of freshwater red algae (Rhodophyta) of South-eastern Australia. *Aust. J. mar. freshw. Res.* 35: 213–59.

Entwisle, T.J. (1989). Macroalgae in the Yarra River basin: flora and distribution. *Proc. Roy. Soc. Vict.* 101: 1–76.

Harvey, W. H. (1841). 'A Manual of the British Algae'. (London.)

Hassall, A.H. (1845). 'A History of the British Freshwater Algae'. 2 Vols. (S. Highley & H. Bailliere: London.)

Holmgren, P.K., Keuken, W. & Schofield, E.K. (1981). 'Index Herbariorum. Part 1. The Herbaria of the World'. 7th Edition. (Bohn, Schellema & Holkema: Utrecht) [*Regnum Vegetabile* Vol. 106]

Hudson, W. (1762). 'Flora anglica'. 2nd ed. (London.)

Israelson, G. (1942). The freshwater Florideae of Sweden. *Symbolae Botanicae Upsaliensis.* 6: 1–135.

Kützing, F.T. (1849). 'Species Algarum'. [Reprinted 1969 (A. Asher: Amsterdam)].

Linnaeus, C. (1753). 'Species Plantarum'. Vol. 2. 1st Ed. [Facsimile 1959, with introduction, xvi pp., and appendix (Ray Society: London.)]

Mori, M. (1975). Studies on the genus *Batrachospermum* in Japan. *Jap. J. Bot.* 20: 461–484.

Necchi, O. Jr (1988). Revisao do Genero *Batrachospermum* Roth (Rhodophyta, Batrachospermales) no Brasil. (PhD Thesis: Universidade Estadual Paulista "Julio de Mesquita Filho", Rio Claro).

Necchi, O. Jr (1990). Revision of the genus *Batrachospermum* Roth (Rhodophyta, Batrachospermales) in Brazil. *Bibliotheca Phycologica* 84: 201 pp.

Necchi, O. Jr & Entwisle, T.J. (1990). A reappraisal of generic and subgeneric classification in the Batrachospermaceae (Rhodophyta). *Phycologia* 29: 478–488.
Pascher, A. & Schiller, J. (1925). Rhodophyta (Rhodophyceen). *In* Pascher, A. (ed.), 'Die Süsswasser-Flora Deutschlands, Österreichs und der Schweiz'. (Verlag von Gustav Fischer: Jena.) pp. 134–206.
Rabenhorst, L. (1868). 'Flora Europaea Algarum Aquae Dulcis et Submarinae...' Vol. 3. (Eduard Kummer: Leipzig.)
Roth, A.W. (1797). 'Catalecta Botanica'. Vol. 1. (I.G. Müllerian: Leipzig.)
Roth, A.W. (1800). 'Tentamen Florae Germanicae...' Vol. 3(2). (I.G. Müllerian: Leipzig.)
Sirodot, S. (1884). 'Les Batrachospermes Organisation, Fonctions, Développement, Classification.' (G. Masson: Paris.)
Smith, J. E. & Sowerby, J. (1800). 'English Botany'. Vol. 10. (London.)
West, W. & West, G.S. (1897). Welwitsch's African freshwater algae [Part 6]. *J. Bot., Lond.* 35: 235–243.

Manuscript received 15 January 1991; revised version received 27 March 1991

A NEW SPECIES OF *POMADERRIS* Labill. (RHAMNACEAE) FROM NORTH-EAST VICTORIA.

by

N.G. WALSH*

ABSTRACT

Walsh, N.G. A new species of *Pomaderris* Labill. (Rhamnaceae) from north-east Victoria. *Muelleria* 7(4): 447–449 (1992). — *Pomaderris subplicata* is described as a new species. Its relationships with other species are discussed and its ecology and conservation status outlined. An illustration is provided.

INTRODUCTION

Several articles by the present author, dealing with taxonomy of *Pomaderris* in south-eastern Australia have been published in *Muelleria* since 1988. The other articles appeared in volumes 6(6), 7(1) and 7(2) (1988, 1989 and 1990 respectively).

TAXONOMY

Pomaderris subplicata N.G.Walsh *sp. nov.*

Pomaderris vaccinifoliae Reiss. affinis, foliis canaliculatis, velutinis pagina supera, ovariis et pagina infera pilis simplicibus et stellatis mixtis differt; *Pomaderris elachophyllae* F.Muell. et *Pomaderris racemosae* Hook. similis sed petalis praesentibus distinguitur praeter.

TYPUS: Victoria, north-east, Carboor Upper, beside Hurdle Ck, alt *c.* 320 m a.s.l., 4.x.1990, *N.G.Walsh 2906* (HOLOTYPUS: MEL 1590325; ISOTYPI BRI,CBG, HO,NSW).

Erect, often multistemmed shrub to *c.* 2 m high. *Petioles* and young branches closely stellate-tomentose with sparsely scattered, longer, simple hairs. *Leaf lamina* ovate, elliptic or obovate, 3–10 × 2–6 mm, obtuse, slightly concave to almost conduplicate; lateral venation indistinct; upper surface velutinous with fine stellate hairs; lower surface appearing whitish from the close stellate tomentum, but with occasional longer (to *c.* 1 mm) coppery, simple, or less commonly, stellate hairs, mostly overlying the veins. *Stipules* subulate, mostly 1–2 mm long, not retained beyond the current seasons growth. *Inflorescence* of small axillary clusters or racemes, crowded, confined to the terminal 1–2 cm of the branchlets. *Pedicels* 1–2.5 mm long. *Sepals* ovate-triangular, spreading, *c.* 1.5 mm long, densely covered externally with pale, fine stellate hairs, with or without a few longer simple hairs, glabrous and pale yellow on inner surface. *Petals* pale yellow, narrowly obovate, sometimes irregularly toothed, 0.5–1 × 0.3–0.5 mm, falling at or very soon after anthesis, shortly fused with the base of the staminal filaments. *Staminal filaments* 1.5–2 mm long; anthers *c.* 0.7 mm long. *Ovary* semi-inferior, conically exserted, somewhat angular, covered with a mixture of minute stellate and longer simple hairs; style branches cleft to base, *c.* 0.5 mm long, stigmas capitate. *Capsule* ovoid, pointed, *c.* 3 mm long; cocci opening via a mebrane which covers most of the inner face. *Seed* oval in outline, plano-convex, *c.* 2 × 1 mm.

OTHER SPECIMENS EXAMINED:

Victoria — from type locality — 22.i.1988, *A.C. Beauglehole 92872*, with *N.A.F. Gibb & R.V. Leeton* (MEL 117483); 13.i.1990, *J.Strudwick 780*, with *N.A.F. Gibb* (MEL 1579917).

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria Australia 3141.

DISTRIBUTION AND CONSERVATION STATUS:

Pomaderris subplicata is known only from the type population of *c.* 150 plants in an area of *c.* 0.25 ha. The population occurs on crown land adjacent to a *Pinus radiata* plantation. The area is not a gazetted biological reserve, but measures have been taken by the local managing authority (Department of Conservation & Environment, Victoria, North-east region) to protect the site and to control a

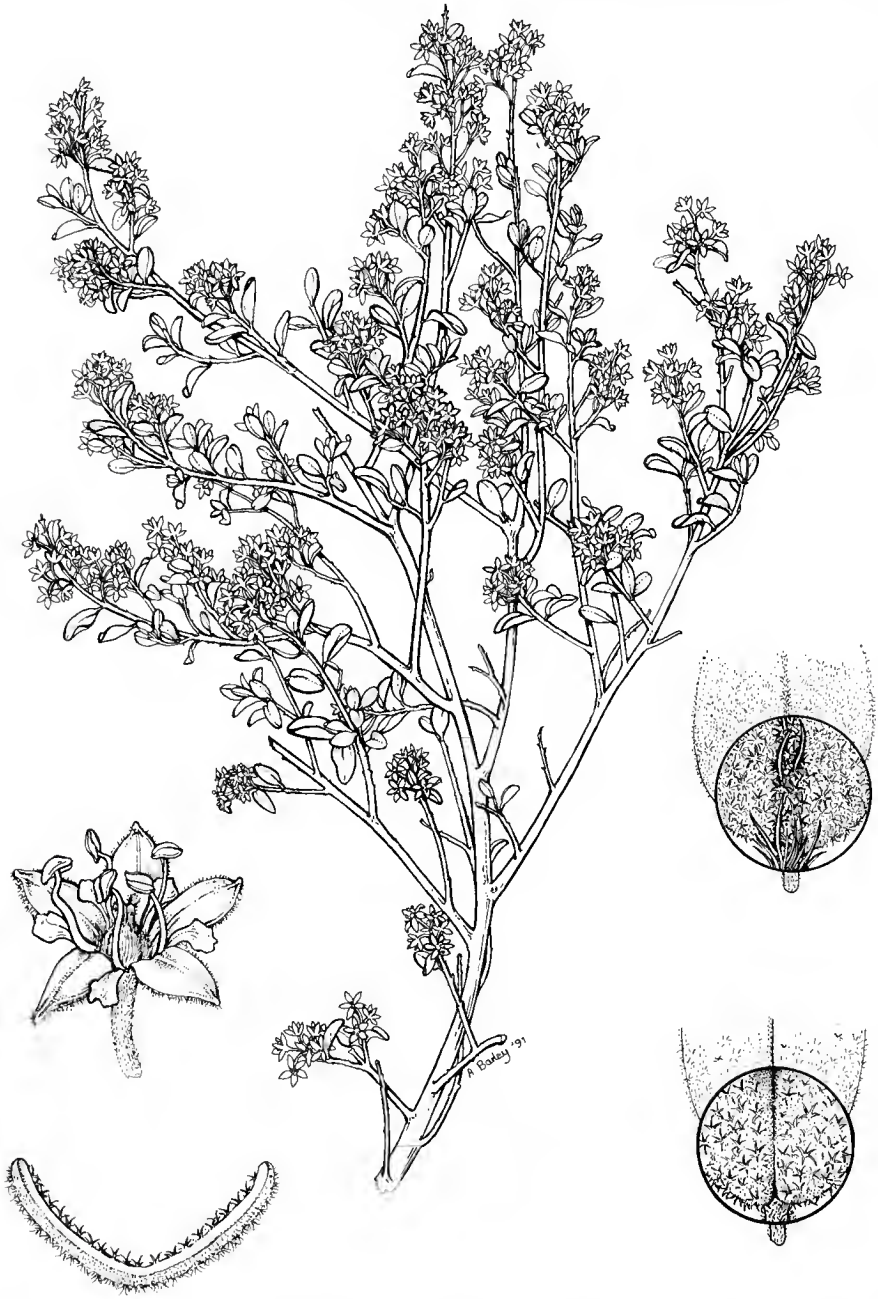


Fig. 1. *Pomaderris subplicata*. a — flowering branch, ×1. b — flower, ×6. c — leaf t.s. ×12. d — leaf lower surface, enlarged section, ×9. e — leaf upper surface, enlarged section, ×9. a-e from the type collection.

dense infestation of blackberry (*Rubus procerus*) which impinges on part of the population and has covered adjacent potential habitat. The small population of *Pomaderris subplicata* and its proximity to an area destined to experience disturbance (for *Pinus radiata* management and removal of logs) suggests the species be regarded as vulnerable, with Risk Code 2vi (Briggs and Leigh, 1989).

HABITAT:

Pomaderris subplicata grows on a steep, rocky, south to south-west facing slope about 50 m from a small permanent creek. The soil is shallow and derived from Ordovician sediments. Annual rainfall is *c.* 1000 mm (Duncan, 1982). The population forms a dense shrubland with scattered *Eucalyptus goniocalyx*, *E. macrorhyncha* and *Acacia dealbata*. A dense bracken fern (*Pteridium esculentum*) layer occurs to the east and downslope on deeper soils.

NOTES:

In the prominently raised ovary, small leaves and general indumentum *P. subplicata* is allied to *P. elachophylla*, *P. racemosa* and *P. vaccinifolia*, but is readily distinguished from these by the velutinous upper surfaces of the leaves and by the presence of some simple hairs intermixed with the dense stellate tomentum of the young branches, abaxial leaf surfaces and the sepals. *Pomaderris subplicata* is further distinguished from *P. elachophylla* and *P. racemosa* in having petals, and from *P. vaccinifolia* by the petals being much smaller than the stamens and falling at or immediately following anthesis. *Pomaderris pallida*, a species of restricted distribution in southern New South Wales and A.C.T., closely resembles *P. subplicata* in the type and disposition of the indumentum, but is apetalous, has larger leaves and lacks a prominently raised ovary. *Pomaderris subplicata* was recorded by Beauglehole (1988) as *P. pauciflora*, an uncommon species of far eastern Victoria and south-eastern New South Wales. *Pomaderris pauciflora* is readily distinguished by its apetalous flowers and the oblong or narrowly obovate leaves which have recurved margins and hispid upper surfaces.

The specific epithet refers to the leaves which remain infolded to varying degrees in their adult state. This feature appears to be unique within the genus although immature leaves of all species are conduplicate. Although normally the prefix *sub* would be assimilated (to *supplicata*), it is deliberately maintained here to avoid confusion with the verb 'supplicate' (to entreat or pray) in its common English usage.

ACKNOWLEDGEMENTS

I am very grateful to Julie Strudwick of Upper Lurg and Russel Leeton of Carboor Upper for collecting material of *P. subplicata* on my behalf, to Alan Gibb of Bobbinawarrah for his hospitality and information regarding the plants. Glen Johnson (Department of Conservation & Environment, Wodonga) is to be commended for promptly responding to requests that measures to be taken to ensure the well-being of the only known population of *P. subplicata*, and I also thank my colleague, Anita Barley for preparing the accompanying illustration.

REFERENCES

Briggs J.D. and Leigh J.H. (1989). 'Rare or Threatened Australian Plants'. (Special Publication 14, Aust. Nat. Parks and Wildlife Serv.: Canberra.)

Beauglehole A.C. (1988). 'The distribution and conservation of vascular plants in the North East area, Victoria'. (A.C. and H.M. Beauglehole, Portland.)

Duncan J.S. (ed) (1982). 'Atlas of Victoria'. (Govt Printer, Melbourne.)

Manuscript received 9 April 1991.

NEW TAXA IN VICTORIAN POACEAE (2)

by

N.G. WALSH*

ABSTRACT

Walsh, N.G. New taxa in Victorian Poaceae (2). *Muelleria* 7(4): 451–456 (1992). — A new variety of *Poa* (*P. hothamensis* var. *parviflora*), and a new species of *Deyeuxia* (*D. pungens*) and *Dichelachne* (*D. hirtella*) are described and illustrated. Their distribution, conservation status, ecology and their relationships with other species are discussed.

INTRODUCTION

This is the second paper by the present author recording new Victorian Poaceae taxa detected in the course of preparing descriptions for a forthcoming state flora. The earlier article appeared in *Muelleria* Vol.7 No. 3 (1991).

TAXONOMY

POA L.

Poa hothamensis Vick. var. **parviflora** N.G. Walsh *var. nov.*

A *P. hothamensis* var. *hothamensis* flosculis parvioribus, foliis subvelutinis paginis ambabis, laminis flaccidis, planis vel plicatis leviter et stolonibus faciendibus saepe differt.

TYPUS: *Victoria*, East Gippsland, Brodribb River near and including BA Creek junction, 17 Jan. 1986, *E.A. Chesterfield 677* (HOLOTYPUS: MEL; ISOTYPI: BRI, CANB,RSA).

Differs from *P. hothamensis* var. *hothamensis* in the following features:

the smaller florets, 1.5–2.6 mm long in var *parviflora*, compared with 2.75–3-75 mm in the typical variety;

the leaf-blades which are flat or weakly folded, flaccid, and moderately densely covered on both surfaces with short, fine, spreading hairs in the new variety, whereas the blades of the typical variety are generally firm, folded, and glabrous or minutely scabrous-pubescent on the lower surface (but with scattered fine hairs on the upper surface);

the lower internodes which are velutinous, with hairs 0.3 mm long or more in var. *parviflora* but smooth to scabrous-pubescent with hairs mostly < 0.1 mm in var. *hothamensis*; the growth habit which is usually stoloniferous in var. *parviflora* but rhizomatous in the typical variety; the inflorescence which in most mature specimens of var. *parviflora* examined are very open, with widely divaricate, almost capillary branches and pedicels, whereas those of var. *hothamensis* are typically rather narrowly pyramidal, with ascending branches and have a 'heavier' appearance. (Fig 1 a-d)

SPECIMENS EXAMINED:

Victoria — East Gippsland, Between Bonang Highway and Mt Ellery, 25 Nov. 1970, *A.C. Beauglehole 34941* (MEL, NSW); East Gippsland, Goolengook Rd, 0.9 km N of Goolengook R, 19 Jan 1989, *I.D. Lunt 312* (MEL); East Gippsland, Brodribb Forest Management Block, 14 Mar. 1986, *E.A. Chesterfield 924* (BRI, CANB, MEL, RSA); East Gippsland, Ellery Forest Block, Sardine Ck Rd, 450 m N of Pumpkin Hill Tk, 7 Jan, 1987, *G.E. Earl 365* (MEL); East Gippsland, Gorge of Rodger R., *c.* 1.5

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.

km upstream from Snowy R confluence, 26 Nov 1990, *N.G. Walsh 3025* (MEL,NSW); Mt Porepunkah, *c.* 8 km N of Bright, 29 Nov. 1973, *A.C. Beauglehole 43677* (MEL, NSW); Pretty Valley Ck, 24 Jan. 1967, *A.C. Beauglehole 22445* (MEL); Rodda Ck Tk, 13 km N of Mt Bogong, 1 Dec. 1973, *A.C. Beauglehole 43705* (MEL).

DISTRIBUTION AND CONSERVATION STATUS:

Poa hothamensis var. *parviflora* is apparently endemic in Victoria with most occurrences in the foothills and lower ranges north of Orbost, East Gippsland, in the catchments of the Yalmy, Rodger and Brodribb Rivers. Most occurrences are within State Forest, but at least one is in the Snowy River National Park. Occurrences north of the Dividing Range in the Bright-Mt Beauty area (e.g. *Beauglehole 43677, 33445, 43705*) are tentatively referred to var. *parviflora* at present (see notes below).

The taxon is regarded as rare by Gullan *et al.* (1990) where referred to as *Poa* sp. aff. *hothamensis.*

HABITAT:

Collectors notes accompanying East Gippsland specimens indicate a tendency for *P. hothamensis* var. *parviflora* to occur on dryish rocky slopes in open forest with canopy species including *Eucalyptus globoidea, E. elata, E. smithii* and *Allocasuarina littoralis,* but occasionally extending to wetter forests of *E. obliqua, E. cypellocarpa* and *E. radiata.* Specimens from the Bright-Mt Beauty area are recorded as being associated with *Eucalptus pauciflora, E. delegatensis* and *E. dives,* but further ecological data are not provided.

This variety appears to inhabit drier sites at lower altitudes (as low as *c.* 150 metres a.s.l.) than does the typical which is a grass of alpine or subalpine shrubland or woodland. Some specimens of var. *parviflora* are from altitudes approaching those at which the typical variety grows, but there is no evidence of the two occurring together.

NOTES:

In the almost velutinous indumentum of var. *parviflora,* there is a resemblance to *P. petrophila* and *P. morrisii,* but from the former, it is distinguishable by the flat leaf-blades and the latter by the purple pigmentation of the sheaths, and from both by its stoloniferous habit, and the broadly divaricate, finely branched panicle with smaller florets and spikelets.

Specimens from the Bright-Mt Beauty area differ slightly from East Gippsland collections in having a coarser indumentum on the outer leaf surface. The inflorescences of these specimens are generally too immature to predict whether the branches will ultimately acquire the sparse, widely divaricate arrangement which is a striking feature of most East Gippsland specimens. Considering these factors and the lack of ecological information available for these collections, they are only tentatively referred to the new variety pending further collections and information.

Occasional plants of *P. hothamensis* var. *hothamensis* growing in deep shade or otherwise very sheltered sites in the alps may be considerably hairier on the sheaths (and rarely, on the lower surface of the blades) and may have less folded blades than nearby specimens growing in the open. In these respects, they may resemble var. *parviflora,* but in the other features discussed above they match the typical variety.

The varietal epithet refers to the small flowers (florets and spikelets) of the new taxon relative to those of var. *hothamensis.*

DEYEUXIA Clar. ex P. Beauv.

Deyeuxia pungens N.G. Walsh *sp. nov.*

Deyeuxia angustifolia Vick. affinis paniculis majoribus, lemmatibus quintuplinervibus, mem-

branaceis internervis, truncatis vel erosis apicibus, arista gracili vel nulla, callo pubescente, ligula longiore, et statura robustiore differt.

HOLOTYPUS: Victoria — East Gippsland, Ballantynes Hills, 8 Jan. 1949, *N.A. Wakefield 2762* (MEL).

Tufted perennial, culms strongly erect, to *c.* 100 cm high. *Leaves* scabrous, rather strongly ribbed; blades mostly closely inrolled, to 45 cm long × 1.5 mm diam, rigidly erect and more or less needle-pointed; ligule papery, acute, soon disintegrating, 4–11 mm long. *Inflorescence* a contracted, almost spike-like panicle, sometimes interrupted and/or narrowly lobed near the base, 10–30 cm × 5–25 mm; spikelets narrow, 4–5 mm long, purplish, maturing to straw-coloured; glumes equal, acuminate, sometimes shortly mucronate, scabrous along the keel, scaberulous on the sides; lemma subequal to glumes, 5-nerved, smooth or sparsely and minutely scabrous, thin-textured between the nerves, hyaline toward the narrowly truncate or erose apex, awnless or awned from just below the apex; awn (when present) fine, straight, to *c.* 0.5 mm long, not exceeding lemma and remaining more or less appressed to it; callus hairs *c.* 1 mm long; rhachilla bristle *c.* 0.3 mm long, glabrous or with a short terminal hair tuft; anthers *c.* 2 mm long. (Fig. 1 e-h)

OTHER SPECIMENS EXAMINED:

Victoria — from type locality: 7 Jan. 1970, *A.C. Beauglehole 33390* (MEL, NSW); 8 Jan. 1949, *N.A. Wakefield 2671* and *2763* (MEL); 16 Jan. 1948, *N.A. Wakefield 2176* (MEL); 16 Jan. 1948, *J.H. Willis* (MEL); Rocky Knob, near Bridle Creek, *c.* 1.6 km S. of Suggan Buggan River crossing, 6 Jan. 1970, *A.C. Beauglehole 33250* (MEL, NSW); Suggan Buggan, Dec. 1939, *W. Hunter* (MEL).

DISTRIBUTION AND CONSERVATION STATUS:

Apparently endemic in Victoria where known only from the type locality at Ballantyne Hills near Suggan Buggan and another site shortly to the north. Both localities are contained within the Alpine National Park (Cobberas-Tingaringy unit). *Deyeuxia pungens* is likely to occur elsewhere in the area and possibly extends across the border (*c.* 13 km away) into New South Wales. The remoteness of and difficult access to similar sites in the area may account for the lack of further records of the species. The species is regarded by Gullan *et al.* (1990) as 'vulnerable'.

HABITAT:

Deyeuxia pungens occurs amongst rocks on and near the summit area of Ballantyne Hills which is a series of turret-like projections of Silurian granite or granodiorite. The mean annual rainfall is *c.* 600 mm, and the altitude *c.* 200 m. Other species occurring in the vicinity include *Eucalyptus nortonii*, *Eriostemon trachyphyllus*, *Phebalium lamprophyllum*, *Olearia iodochroa*, *Psilotum nudum* and *Haloragodendron bauerlenii*, the latter two species being regarded as 'rare' in Victoria (Gullan *et al.*, 1990).

NOTES:

This species has been referred to as *Deyeuxia* sp. aff. *angustifolia* (e.g. Willis, 1970; Ross, 1990) following determination of a specimen sent to the late J.W. Vickery (NSW) in 1948. With her determination, Vickery noted several features which differed from the typical form of *D. angustifolia* 'viz. callus somewhat hairy, spikelets very slightly shorter, awn inconspicuous and not thickened'. Further examination shows *D. pungens* to consistently differ from *D. angustifolia* in the larger panicle, the virtually smooth (*c.f.* densely scaberulous), 5- (not 7-) nerved lemma which is membranous (*c.f.* firm) between the nerves, and erose (*c.f.* truncate or bifid) at the apex, the longer, papery (*c.f.* membranous) ligule and the generally more robust habit. True *D. angustifolia* is a rather localized grass occur-

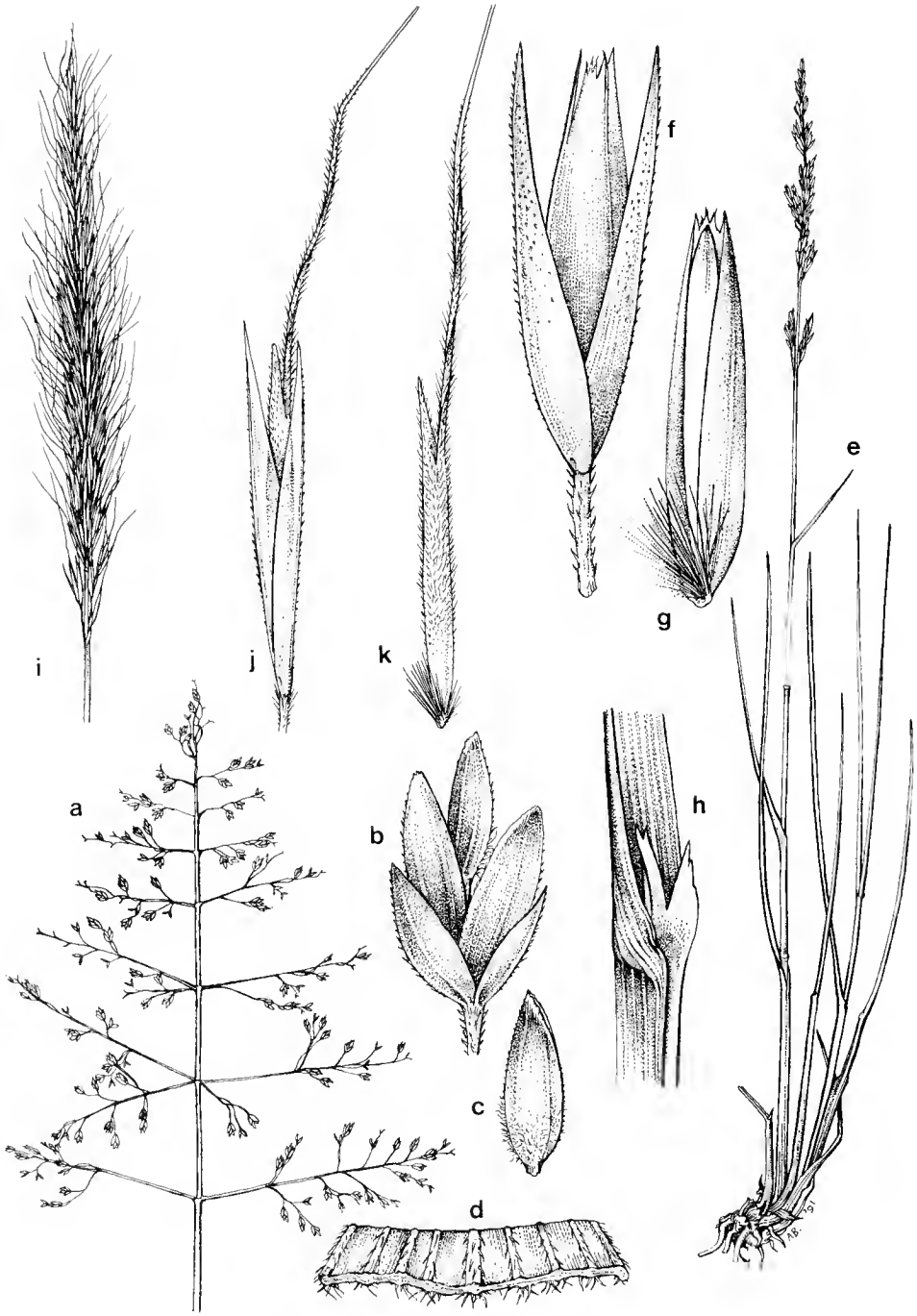


Fig. 1. *Poa hothamensis* var. *parviflora*. a — inflorescence ×2/3. b — spikelet ×12. c — lemma ×12. d — t.s. leaf blade ×15. a-d from the holotype (MEL). *Deyeuxia pungens*. e — habit ×1/3. f — spikelet ×12. g — floret ×12. h — ligule and part of leaf ×6. e-h from *Wakefield 2761* (MEL). *Dichelachne hirtella*. i — inflorescence ×1/2. j — spikelet ×6. k — floret ×6. i–k from the holotype (MEL).

ring on sandstones of the Central and Southern Tablelands of New South Wales.

The specific epithet refers to the stiff, needle-pointed leaves.

DICHELACHNE Endl.

Dichelachne hirtella N.G. Walsh *sp. nov.*

Dichelachne rara (R. Br.) Vick. affinis lemmate longiore, brevo-pubescente, lobis apicibus longioribus, arista longiora et pubescenti differt.

HOLOTYPUS: Victoria — Grampians, Mt Arapiles, on top, within *c.* 250 yards S to W of P.M.G. tower, *A.C. Beauglehole 29609* (MEL).

Narrowly tufted annual or perennial with culms erect, mostly to *c.* 60 (rarely to *c.* 150) cm high. *Leaves* smooth or scabrous, glabrous to shortly pubescent; blades flat or weakly folded, to 15 cm long, 1–4 mm wide; ligule membranous, truncate, to 1.5 mm long. *Inflorescence* a moderately to quite dense, cylindrical panicle (6–) 8–15 (–25) cm long, with short, erect branches bearing spikelets from the base; glumes narrowly acute, 6.5–10 (mostly 7–8) mm long, subequal, rarely the lower up to 1.5 mm shorter than the upper; floret slender, subequal to lower glume, 6–8 mm long; lemma scabrous-pubescent with hairs 0.2–0.3 mm long, sometimes subglabrous near base; awn inserted 1–2 (av. 1.4) mm from lemma apex, (15–) 20–26 (–30) mm long, column pubescent with hairs to 0.3 mm long, twisted, bristle scabrous, narrower than column and not twisted; palea reaching to about the point of attachment of awn, glabrous or weakly pubescent along the midline and upper margins; callus hairs 1–1.8 mm long; anthers 2 or 3 in specimens observed, c. 0.5 mm (cleistogamous florets) or 1–1.5 mm (chasmogamous florets). (Fig. 1 i-k)

OTHER SPECIMENS EXAMINED:

Victoria — Burrowa National Park, Jemba Reference area, 24 Oct. 1987, *A.C. Beauglehole 89279* (MEL); Chiltern Regional Park, 15 Nov. 1987, *A.C. Beauglehole 92028* (MEL); Grampians, Mt Zero-Mt Stapylton area, 5 Nov. 1967, *A.C. Beauglehole 17852* (MEL); 2 km SSE of Red Bank, 37 km S of St Arnaud, 22 Nov. 1979, *A.C. Beauglehole 66628A* (MEL); Stawell, Three Jacks Reserve — fenced plot, 17 Nov. 1966, *A.C. Beauglehole 22008* (MEL); Mt Buffalo Reference area, 19 Nov. 1987, *A.C. Beauglehole 92361* (MEL); Wellsford Forest, 14 km NE of Bendigo, 24 Jul. 1975, *A.C. Beauglehole 50006* (MEL); Junction Macalister and Caledonia River, 7 Dec. 1973, *E.A. Chesterfield* (MEL); McKenzie Flora Reserve near Alexandra, 8 Nov. 1985, *J. Edwards 23* (MEL); Wabonga State Park, 1 km S of Cherry Tree junction, 14 Jan. 1987, *A. Piesse 757* (MEL); Creswick, mid Nov. 1928, *J.H. Willis* (MEL).

New South Wales (including A.C.T.) — Lower western slope of Mt Jerrabombera, Queanbeyan, 23 Nov. 1961, *R. Pullen 2967* (A,BM,BRI,CANB,G,K,L,MEL,NE,NSW,US); Dividing Range, between Braidwood and Bungendore, 6 Dec. 1963, *R. Pullen 3976* (CANB); Kowen Forest, north-eastern A.C.T., 8 Dec. 1966, *R. Pullen 4234* (AD,BAA,CHR,K,NSW,US); Weetangera Rd, Canberra, A.C.T., 7 Nov. 1959, *R. Pullen 1958* (CANB,NSW); near Botanic Gardens reserve on E. side of Black Mtn, Canberra, A.C.T., 4 Jan. 1959, *R. Pullen 1249* (AD,NSW)

DISTRIBUTION AND CONSERVATION STATUS:

Known in Victoria from the Grampians in the west to central Gippsland in the east, extending to the N.S.W. border in the north-east. The species also occurs in southern New South Wales in the Queanbeyan-Braidwood district, and in the Australian Capital Territory (Southern Tablelands Division). *D. hirtella* is well represented in biological reserves and is not considered to be rare.

HABITAT:

Most collections of *D. hirtella* are from rather dry (500–800 mm av. annual rainfall) areas with skeletal, often rocky soils. Ecological notes accompanying specimens give 'peppermint open forest with low shrubland and open grassland below' (*Piesse 757*), 'dry sclerophyll forest (with) *Eucalyptus polyanthemos*, *E. macrorhyncha*, *E. melliodora* & *E. camaldulensis*' (*Edwards 23*), 'heathy woodland' (*Pullen 2967*).

NOTES:

Specimens of *D. hirtella* have been identified as *D. rara* (R.Br.) Vick. and, prior to treatments such as Edgar and Connor (1982) and Veldkamp (1974), as *D. micrantha* (Cav.) Domin and *D. sciurea* (R.Br.) Hook. f. In overall appearance, *D. hirtella* is virtually indistinguishable from *D. rara*, and several mixed collections containing both species exist at MEL. The new species is readily separated from *D. rara* by the scabrous-pubescent lemma and awn, and by the more distant insertion of the awn from the lemma apex. The lemma of *D. rara* is glabrous, sometimes finely scabrous toward the apex, but never scabrous-pubescent, and the awn is scabrous only. The awns of *D. rara* are inserted 0.1–1.0 mm (av. 0.4 mm) from the lemma apex (compared with 1–2 mm, av. 1.4 mm, for *D. hirtella*). The floret of *D. hirtella* is generally longer than that of *D. rara* (6–8 mm, av. 6.8 mm, compared with 4–6 mm, av. 5.1 mm) as is the awn (15–30 mm, av. 22 mm, compared with 9–23 mm, av. 17 mm) although there is a small degree of overlap in these features. These measurements for floret and awn characters of *D. rara*, derived from numerous specimens at MEL and CANB, agree generally with those given by Veldkamp (1974) and Edgar & Connor (1982).

The specific epithet refers to the scabrous-hairy indumentum of the lemma and awn.

ACKNOWLEDGEMENTS

I am grateful to Dr Elizabeth Edgar of DSIR, Christchurch, New Zealand for her helpful comments regarding *Dichelachne*, to Dennis Morris of HO for his comments on an earlier draft of the paper, to the Directors/Curators of BM, CANB, CBG and WELT for provision of specimens, and to Anita Barley (MEL) for drawing the new taxa described herein.

REFERENCES

Briggs, J.D. & Leigh, J.H. (1989). 'Rare or threatened Australian plants 1988 revised edition.' (Special publication no. 14. Aust. Nat. Parks & Wildlife Serv.: Canberra.)

Edgar, E. & Connor, H.E. (1982). *Dichelachne* in New Zealand. *New Zealand J. Bot.* 20:303–309.

Ross, J.H. (1990). 'A census of the vascular plants of Victoria, 3rd edition.' (National Herbarium of Victoria, Melbourne.)

Gullan, P.K., Cheal, D.C. and Walsh, N.G. (1990). 'Rare or threatened plants in Victoria'. (Department of Conservation and Environment, East Melbourne.)

Veldkamp, J.F. (1974). A taxonomic revision of *Dichelachne* Endl. (Gramineae) with some new compinations in *Stipa* L. and *Oryzopsis* Michx. *Blumea* 22:5–12.

Vickery, J.W. (1940). A revision of the Australian species of *Deyeuxia.... Contr. New South Wales Natl Herb.* 1:43–82.

Vickery, J.W. (1970). A taxonomic study of the genus *Poa* in Australia. *Contr. New South Wales Natl Herb.* 4:145–243.

Willis, J.H. (1970). A handbook to plants in Victoria, vol. I. (Melbourne University Press, Carlton.)

Manuscript received 30 April 1991; amended 26 November 1991.

CHROMOSOME NUMBER DETERMINATIONS IN *BRACHYSCOME* Cass. (ASTERACEAE: ASTEREAE) WITH COMMENTS ON SPECIES DELIMITATION, RELATIONSHIPS AND CYTOGEOGRAPHY

by

K. WATANABE[1] and P.S. SHORT[2]

ABSTRACT

Watanabe, K. and Short, P.S. Chromosome number determinations in *Brachyscome* Cass. (Asteraceae: Astereae) with comments on species delimitation, relationships and cytogeography. *Muelleria* 7(4): 457–471 (1992). — Chromosome number determinations from 145 populations attributed to 29 species or species complexes of *Brachyscome* are reported. First reports for *B. gracilis* (2n = 8), *B. muelleri* (n = 3, 2n = 6), *B. rara* (n = 6, 2n = 12), *B. readeri* (2n = 10), *B. riparia* (n = 9), and *B. tetrapterocarpa* (n = 4, 2n = 8), and new reports for the *B. diversifolia* (2n = 24) and *B. campylocarpa* complexes (n = 3, 2n = 6) are presented. Remaining counts support previously reported determinations and add to knowledge of chromosome number distribution. Polyploidy is common in the widespread *B. ciliaris* and *B. dentata* complexes. In the apomictic *B. ciliaris* group triploids and tetraploids are widespread, the diploids have restricted distributions. Problems with the delimitation of many species are discussed.

INTRODUCTION

Brachyscome Cass., a genus to which more than 70 species are currently attributed, exhibits a wide diversity of chromosome numbers, with Smith-White *et al.* (1970) reporting observations for 43 recognised taxa and for some undescribed entities. The work showed that the revision by Davis (1948) was inadequate, the group requiring a revision which took into account chromosome data and field observations. Since that time, further investigations within the genus have mainly concerned the elucidation of taxa and relationships within the *B. lineariloba* complex (e.g. Kyhos *et al.* 1977, Carter 1978b, Watanabe and Smith-White 1987). One of us (KW) is still carrying out cytological and molecular research in the genus, studying for example chromosome pairing in artificial hybrids and chloroplast DNA, while the other (PSS) has commenced a taxonomic revision of the genus which will incorporate cytological and molecular data, with data on breeding systems, fruit anatomy, etc. In this paper we extend the available chromosome data and briefly outline some of the taxonomic problems so far encountered, make observations on species relationships, and comment on the cytogeography of some species. Chromosome number determinations are primarily the work of Watanabe, taxonomic interpretation the work of Short.

There is also an additional need for this paper. Unfortunately many of the reports published by Carter (1978a) apparently lack extant voucher specimens and some of the specimens gathered by Smith-White *et al.* (1970), although usually identifiable, have been damaged by insects.

MATERIALS AND METHODS

Chromosome counts were obtained from either floral bud material fixed in the field, or from root tips obtained from seedlings grown, from fruit of known provenance, in the greenhouse of Kobe University. For the cultivation of specimens and the preparation of material for chromosome number determinations

[1] Biological Institute, Faculty of General Education, Kobe University, Kobe 657, Japan
[2] National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141

the proccdures of Smith-White *et al.* (1970) and Watanabe *et al.* (1975) were followed. With the exception of *B. rara* (specimen in AD), two collections (*Short 3550* and *Short 3646*) of *B. dentata* (seed only), and two collections currently held in the private herbarium of the Australian Daisy Study Group (ADSG), a complete set of voucher specimens has been deposited in MEL. Following completion of a taxonomic revision duplicate voucher collections of non-Victorian populations will be deposited in the major government herbarium (AD, BRI, NSW, PERTH) of the State from which collections were gathered. An incomplete set has already been deposited with TNS.

Percentage pollen sterility was usually only estimated by using the double stain method (phloxine and methyl green; Owczarzak 1952). For each population (or collection) estimates were usually obtained from 15 florets, each of which came from a different plant. The material used for pollen sterility estimates was gathered in the field and stored in 70% ethanol. For members of the *B. dentata* complex, estimates of pollen sterility were also ascertained using 1% acetocarmine (for several plants only, a single value of percentage sterility being ascertained) as well as the double stain method.

RESULTS

All chromosome determinations are presented in Table I. The meiotic or mitotic chromosomes of some species are displayed in Fig. 1, and the distribution of the different ploidy levels in the *B. ciliaris* complex and *B. dentata* are shown in Figs 2 & 3.

Table I. Chromosome number determinations in *Brachyscome*

Species & locality	n	2n
B. basaltica F. Muell. var. **gracilis** Benth.		
Taylors Lake, 2 km SE of Sydenham, Vict., 12.i.1986, *Albrecht 2719*	6II	
4.2 km NW of Bearii, Vict., 14.xi.1988, *Short 3358*		12
B. breviscapis C.R. Carter		
19 km from Streaky Bay along Ceduna road and opposite Eba Island, S.A., 30.viii.1989, *Short 3738*	4II	
4.5 km from intersection with Elliston — Lock road along Mt Wedge — Colton road, S.A., 31.viii.1989, *Short 3742*	4II	
B. sp. aff. **campylocarpa** J.M. Black		
7 km N of Barringun, Qld, 15.viii.1989, *Short 3566*	3II	6
6.7 km E of Enngonia, N.S.W., 21.vii.1989, *Salkin s.n.* (ADSG 52)		12 or 12 + 2B
37 km N of Bourke, N.S.W., 15.viii.1989, *Short 3557*	3IV-6II	12
B. ciliaris (Labill.) Less. complex		
10 km W of Cockburn, S.A., 22.viii.1989, *Short 3657*		27
24.5 km SW of Olary, S.A., 22.viii.1989, *Short 3658*		27
77 km S of Pimba, S.A., 25.viii.1989, *Short 3664*		27
36 km E of Kimba, S.A., 29.viii.1989, *Short 3719*		27
8 km from Wirrealpa along Blinman road, Flinders Ranges, S.A., 1.ix.1989, *Short 3752*	27I (0–8II)	
24 km N of Wirrealpa, Flinders Ranges, S.A., 1.ix.1989, *Short 3756*		27
8 km from Broken Hill to Tibooburra road along road to White Cliffs, N.S.W., 19.viii.1989, *Short 3630*		27
16 km N of Barrier Hwy along road to Tilpa, N.S.W., 20.viii.1989, *Short 3639*		27
52 km W of Wilcannia, N.S.W., 21.viii.1989, *Short 3645*		27
4 km N of Pt Augusta, S.A., 25.viii.1989, *Short 3659*	36I (0–6II)	
8 km N of Glendambo, S.A., 26.viii.1989, *Short 3671*		36
8 km N of Glendambo, S.A., 26.viii.1989, *Short 3672*		36
54 km N of Glendambo, S.A., 26.viii.1989, *Short 3680*		36

Species & locality	n	2n
119 km N of Glendambo, S.A., 26.viii.1989, *Short 3681*		36
10 km E of Evelyn Downs, S.A., 27.viii.1989, *Short 3698*		36
17 km S of Cadney Park, S.A., 28.viii.1989, *Short 3700*		36
17 km S of Cadney Park, S.A., 28.viii.1989, *Short 3701*		36
84 km N of Glendambo, S.A., 28.viii.1989, *Short 3703*		36
22 km NE of Iron Knob, S.A., 29.viii.1989, *Short 3709*		36
36 km E of Kimba, S.A., 29.viii.1989, *Short 3718*		36
4 km NW of Kyancutta, S.A., 29.viii.1989, *Short 3723*		36
19 km from Streaky Bay along Ceduna road, S.A., 30.viii.1989, *Short 3739*		36
20 km E of Cowell, S.A., 31.viii.1989, *Short 3746*		36
20 km E of Cowell, S.A., 31.viii.1989, *Short 3747*		36
4.5 km along road to Chambers Gorge from the Blinman to Arkaroola road, Flinders Ranges, S.A., 1.ix.1989, *Short 3758*		36
18 km from Murray Bridge along Karoonda road, S.A., 4.ix.1989, *Short 3765*		36
17 km S of Cunnamulla, Qld, 16.viii.1989, *Short 3575*		36
1 km S of Wyandra, Qld, 16.viii.1989, *Short 3582*		36
6 km N of Charleville, Qld, 17.viii.1989, *Short 3593*		36
8 km NNE of Noccundra, Qld, 18.viii.1989, *Short 3619*		36
11 km W of Bourke, N.S.W., 15.viii.1989, *Short 3553*		36
22 km N of Bourke, N.S.W., 15.viii.1989, *Short 3556*		36
4.5 km S of Tibooburra, N.S.W., 19.viii.1989, *Short 3624*		36
66 km S of Tibooburra, N.S.W., 19.viii.1989, *Short 3628*		36
28 km NE of Wilcannia along road to Tilpa, N.S.W., 20.viii.1989, *Short 3643*		36
20 km W of Wilcannia, N.S.W., 21.viii.1989, *Short 3644*		36
76 km W of Wilcannia, N.S.W., 21.viii.1989, *Short 3648*		36
200 m from S.A./Vict. border along Sturt Hwy, Vict, 4.ix.1989, *Short 3768*		36
31 km S of Ouyen, Vict., 5.ix.1989, *Short 3771*	36I (sometimes including II, IV)	
var. **lyrifolia** (J.M. Black) G.L. Davis		
Parachilna Gorge, Flinders Ranges, S.A., 1.ix.1989, *Short 3749*	9II	
B. ciliocarpa W.V. Fitzg.		
41 km E of Quilpie, Qld, 17.viii.1989, *Short 3607*	9II	18
B. curvicarpa G.L. Davis		
5 km W of Walgett, N.S.W., 15.viii.1989, *Short 3549*	4II	
18 km N of Bourke, N.S.W., 15.viii.1989, *Short 3554*	4II	
1.5 km SE of Wilcannia, N.S.W., 20.viii.1989, *Short 3633*	4II	
B. aff. **curvicarpa** (yellow ray florets)		
27 km N of Wyandra, Qld, 16.viii.1989, *Short 3587*	4II + BI	8 or 8 + 3B
0.7 km N of Charleville Post Office, Qld, 17.viii.1989 *Short 3592*	4II	8
43 km N of Charleville, Qld, 17.viii.1989, *Short 3597*	4II + BI	
B. debilis Sonder		
Mt Arapiles, Vict., 13.x.1990, *Short 3916*	3II	6
B. **dentata** Gaudich.		
24 km N of Wirrealpa, Flinders Ranges, S.A., 1.ix.1989, *Short 3755*	4II + BII or 2BI	8 & 8 + 2B
1.5 km SE of Wilcannia, N.S.W., 20.viii.1989, *Short 3634*	4II	
1.5 km S of Cunnamulla, Qld, 16.viii.1989, *Short 3577*	1IV + 6II or 8II	
27 km N of Wyandra, Qld, 16.viii.1989, *Short 3583*	1IV + 6II + BII or 8II + BII or 8II + 2BI	
21 km SW of Charleville, Qld, 17.viii.1989, *Short 3599*	8II + BII or 2BI	
53 km N of Coonamble, N.S.W., 14.viii.1989, *Short 3547*	8II	16 or 16 + 1B
47 km S of Walgett, N.S.W., 14.viii.1989, *Short 3548*		16
52 km W of Walgett, N.S.W., 14.viii.1989, *Short 3550*		16 + 1B
16.5 km N of Enngonia, N.S.W., 15.viii.1989, *Short 3564*	8II + BII	

Species & locality	n	2n
8 km from Broken Hill to Tibooburra road along road to White Cliffs, N.S.W., 19.viii.1989, *Short 3631*	1IV +6II or 8II	
52 km W of Wilcannia, N.S.W., 21.viii.1989, *Short 3646*	1IV + 6II or 8II	
76 km W of Wilcannia, N.S.W., 21.viii.1989, *Short 3649*	8II + BII	
50 km W of Broken Hill, N.S.W., 21.viii.1989, *Short 3650*	1IV + 6II + BII or 8II + BII or 8II + 2BI	
34 km S of Tibooburra, N.S.W., 19.viii.1989, *Short 3626*	12II + BI	
54 km S of Tibooburra, N.S.W., 19.viii.1989, *Short 3627*	12II + BI	
16 km N of Barrier Hwy along road to Tilpa, N.S.W., 20.viii.1989, *Short 3638*	1IV + 10II + BI or 12II + BI	
19 km N of Barrier Hwy along road to Tilpa, N.S.W., 20.viii.1989, *Short 3641*		24 + 1B
9 km S of Patchewollock, Vict., 5.ix.1989, *Short 3773*	12II	
4 km W of Hopetoun, Vict., 5.ix.1989, *Short 3774*	12II + BI	
B. diehromosomatica C.R. Carter		
var. **diehromosomatica** Cytodeme A1 (Watanabe *et al.* 1975)		
16 km N of Pt Augusta, S.A., 25.viii.1989 & 31.viii.1989, *Short 3662*	2II	
c. 12–17 km N of Simmonston along road to Yappala Homestead, S.A., 2.ix.1989, *Short 3761 p.p.*		4
18 km W of Pt Augusta, S.A., 29.viii.1989, *Short 3708*	2II	
22 km NE of Iron Knob, S.A., 29.viii.1989, *Short 3711*	2II	
var. **diehromosomatica** Cytodeme A2 (Watanabe *et al.* 1975)		
3 km S of Pimba, S.A., 25.viii.1989, *Short 3668*		4
65 km N of Hawker, S.A., 2.ix.1989, *Short 3760*		4
var. **diehromosomatica** Cytodemes A2 & A4 (Watanabe *et al.* 1975)		
c. 12–17 km N of Simmonston along road to Yappala Homestead, S.A., 2.ix.1989, *Short 3761 p.p.*		4
var. **alba** C.R. Carter		
16 km N of Barrier Hwy along road to Tilpa, N.S.W., 20.viii.1989, *Short 3637*	2II	
B. diversifolia (Graham) Fischer & C. Meyer var. **diversifolia**		
5 km W of Stawell, Vict., 12.ix.1988, *Short 3345*		24
B. eriogona (J.M. Black) G.L. Davis		
3 km S of Pimba, S.A., 25.viii.1989, *Short 3669*	4II	8
20 km N of Coober Pedy, S.A., 26.viii.1989, *Short 3684*	4II	
12 km N of Arckaringa Creek along the Coober Pedy to Oodnadatta road, S.A., 27.viii.1989, *Short 3687*	4II	
0.5 km N of Arckaringa Creek along the Coober Pedy to Oodnadatta road, S.A., 27.viii.1989, *Short 3693*	4II	
25 km W of Mt Barry Homestead, S.A., 27.viii.1989, *Short 3697*	4II	
8 km N of Evelyn Downs, S.A., 27.viii.1989, *Short 3699*	4II	
B. exilis Sonder		
Daly Head, Yorke Pen., S.A., 10.x.1990, *Short 3908*	9II	
B. gonioearpa Sonder & F. Muell.		
22 km W of Lock, S.A., 31.viii.1989, *Short 3743*	4II	8
Mt Arapiles, Vict., 5.ix.1989, *Short 3775*	4II	
B. sp. aff. **gonioearpa**		
Watson St., Cunnamulla, Qld, 11.viii.1989, *Salkin s.n.* (ADSG)		6
B. gracilis G.L. Davis		
Killawarra State Forest, Vict., 15.xi.1988, *Short 3361*		8

Species & locality	n	2n
B. aff. **gracilis**		
Kings Billabong State Game Reserve, near Mildura, Vict., 19.x.1987, *Browne 397*		24
B. halophila P.S. Short		
13 km N of Three Springs, W.A., 21.ix.1990, *Short 3855*		18
B. iberidifolia Benth. complex		
Karolin Rock, W.A., 16.ix.1990, *Short 3810*	9II	
Dookanooka Nature Reserve, W.A., 21.ix.1990, *Short 3860*	9II	
Tutanning Reserve, W.A., 25.ix.1990, *Short 3874*	9II	
8 km N of Glendambo, S.A., 26.viii.1989, *Short 3673*	9II	
119 km N of Glendambo, S.A., 26.viii.1989, *Short 3682*	9II	
27 km S of Hiltaba Homestead, S.A., 30.viii.1989, *Short 3733*	9II	
B. lineariloba (DC.) Druce		
Cytodeme E (Carter 1978b)		
12.5 km W of Kimba, S.A., 29.viii.1989, *Short 3721 & 3722*	4II + 2I	
19 km from Streaky Bay along Ceduna road and opposite Eba Island, S.A., 30.viii.1989, *Short 3737*	4II + 2I	
22 km W of Lock, S.A., 31.viii.1989, *Short 3744*	4II + 2I	
Cytodeme B		
22 km NE of Iron Knob, S.A., 29.viii.1989, *Short 3710*	6II	
4 km NW of Kyancutta, S.A., 29.viii.1989, *Short 3724*	6II	
44 km NE of Minnipa, S.A., 30.viii.1989, *Short 3725*	6II	
10 km SE of Hiltaba, S.A., 30.viii.1989, *Short 3729*	6II	
4 km SSE of Halidon, S.A., 3.ix.1989, *Short 3766*	6II	-
200 m from S.A./Vict. border along Sturt Hwy, Vict., 4.ix.1989, *Short 3769*	6II	
Cytodeme C		
2 km NE of vermin proof fence along Cleary to Paynes Find road, W.A., 16.ix.1990, *Short 3819*		16
10 km W of Cockburn, S.A., 22.viii.1989, *Short 3656*	8II	
7 km NE of Oodla Wirra, S.A., 22.viii.1989, *Short 3661*	8II	
Cutting Creek, 4.5 km S of Tibooburra, N.S.W., 19.viii.1989, *Short 3625*	8II	
76 km W of Wilcannia, N.S.W., 21.viii.1989, *Short 3647*	8II	
2 km NW of Yanco Glen, N.S.W., 21.viii.1989, *Short 3653*	8II	
B. melanocarpa Sonder & F. Muell.		
35 km S of Cunnamulla, Qld, 17.viii.1988, *Short 3164*		12
7 km N of Barringun, Qld, 15.viii.1989, *Short 3570*	6II	
1.5 km S of Cunnamulla, Qld, 16.viii.1989, *Short 3578*	6II	
16.5 km N of Enngonia, N.S.W., 15.viii.1989, *Short 3563*	6II	
B. muelleri Sonder		
Corunna Hill South, S.A., 29.viii.1989, *Short 3713*	3II	6
B. multifida DC.		
Clover Flat Power Station, Vict., 18.i.1988, *Short 3080*	9II	
2 km towards Zumsteins from the turn-off to MacKenzie Falls along the Halls Gap to Zumsteins road, Vict., 12.ix.1988, *Short 3347*	9II	18
B. oncocarpa Diels		
12 km N of turn-off to Bimbijy Stn along the Cleary to Paynes Find road, W.A., 17.ix.1990, *Short 3823*	9II	
B. perpusilla (Steetz) Benth.		
2 km NE of vermin proof fence along Cleary to Paynes Find road, W.A., 16.ix.1990, *Short 3818*		18
Corunna Hill South, S.A., 29.viii.1989, *Short 3715*	9II	
Mt Arapiles, Vict., 5.ix.1989, *Short 3776*	9II	
B. rara G.L. Davis		
Lake Apachirie, S.A., 18.v.1987, *Gillen & Reid 852*	6II	12

Species & locality	n	2n
B. readeri G.L. Davis		
Tallagiera Forest, Vict., 2.xi.1990, *Short 3917*		10
B. rigidula (DC.) G.L. Davis		
Quartz Ridge, Bogong National Park, Vict., 18.i.1988, *Short 3086*	9II	
B. riparia G.L. Davis		
Tulach Ard Gorge, Vict., 15.xi.1988, *Walsh 2409*	9II	
B. tetrapterocarpa G.L. Davis		
30 km E of Eromanga, Qld, 18.viii.1989, *Short 3609*	4II or 4II + 1B	8
30 km SW of Eromanga, Qld, 18.viii.1989, *Short 3611*	4II	8
B. whitei G.L. Davis		
41 km S of Charleville, Qld, 16.viii.1988, *Short 3159*	5II	10
27 km S of Cunnamulla, Qld, 16.viii.1989, *Short 3574*	5II	
1 km S of Wyandra, Qld, 16.viii.1989, *Short 3581*	5II	
6 km N of Charleville, Qld, 17.viii.1989, *Short 3594*	5II	
43 km N of Charleville, Qld, 17.viii.1989, *Short 3596*	5II	
13 km W of Charleville, Qld, 17.viii.1989, *Short 3598*	5II	
80 km SW of Charleville, Qld, 17.viii.1989, *Short 3601*	5II	
25 km W of Parroo River along Charleville to Quilpie road, Qld, 17.viii.1989, *Short 3602*	5II	
34 km S of Bourke, N.S.W., 17.viii.1988, *Short 3167*	5II	10
51 km S of Enngonia, N.S.W., 15.viii.1989, *Short 3561*	5II	

Chromosome number determinations from 145 populations attributed to 29 species or species complexes of *Brachyscome* are reported. First reports for *B. gracilis* (2n = 8), *B. muelleri* (n = 3, 2n = 6), *B. rara* (n = 6, 2n = 12), *B. readeri* (2n = 10), *B. riparia* (n = 9), and *B. tetrapterocarpa* (n = 4, 2n = 8), and new reports for the *B. diversifolia* (2n = 24) and *B. campylocarpa* complexes (n = 3, 2n = 6) are presented. The presence of B chromosomes are newly reported for members of the *B. dentata* complex, i.e. *B.* aff. *curvicarpa* (yellow ray florets) and *B. tetrapterocarpa.*

Data pertaining to pollen sterility are summarised in Table II.

DISCUSSION

The taxonomic revision of *Brachyscome* is in its infancy. It has not been possible as yet to view all type material or literature, and few species have been satisfactorily sorted. This work will not be completed for some years. Therefore, in this paper, reference to species and species complexes largely follows the concepts of Smith-White *et al.* (1970), their work in turn having been strongly based on that by Davis (1948). This is not an entirely desirable step to take, particularly in regard to the species complexes, where morphological and chromosomal evidence suggests that members of the ill-defined *B. campylocarpa*, *B. diversifolia* and *B. lineariloba* complexes are closely related. Nonetheless, this approach maintains continuity with past papers, and still provides a useful framework for discussion of the taxonomic problems encountered, probable new taxa, species relationships and cytogeography. However, we have refrained from referring to Davis's superspecies, and also to the invalidly published subgeneric names (Davis 1948). All, or nearly all, such categories are likely to prove artificial.

Brachyscome campylocarpa Complex (including *B. eriogona*)

Smith-White *et al.* (1970) recognised three species within *B. campylocarpa* (sp. A, n = 4; sp. B, n = 5; sp. C, n = 6), which they noted, 'is morphologically rather

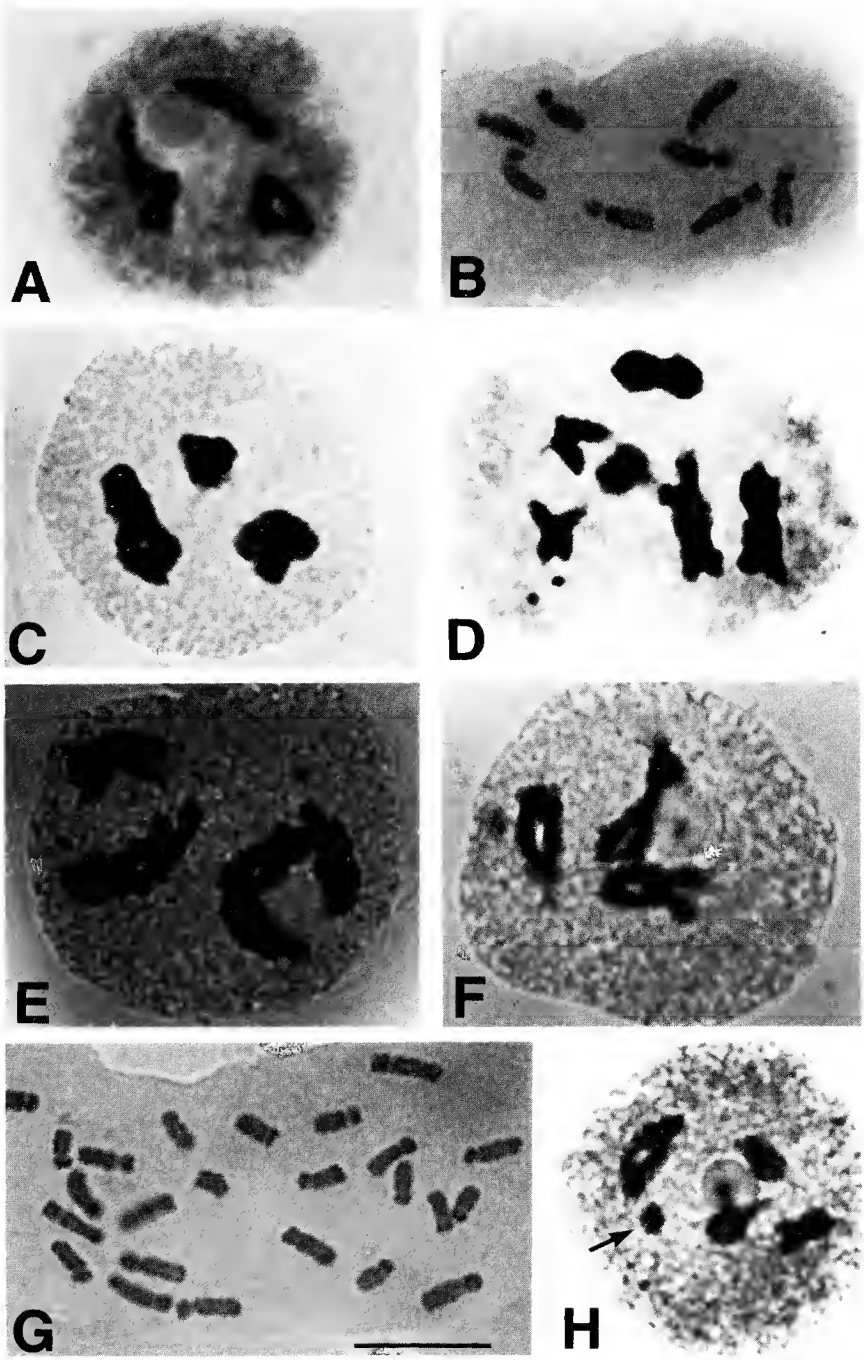


Fig. 1. Mitotic and meiotic chromosomes in *Brachyscome*. A — *B. goniocarpa* n = 4II (*Short 3743*). B — *B. gracilis* 2n = 8 (*Short 3361*). C — *B. muelleri* n = 3II (*Short 3713*). D — *B. rara* n = 6II (*Gillen & Reid 852*). E — *B. tetrapterocarpa* n = 4II (*Short 3611*). F — *B.* sp. aff. *campylocarpa* n = 3II (*Short 3566*). G — *B. diversifolia* 2n = 24 (*Short 3345*). H — *B.* aff. *curvicarpa* (yellow rays) n = 4II + 1B (*Short 3587*), arrow indicates B chromosome. Scale: 10 μm

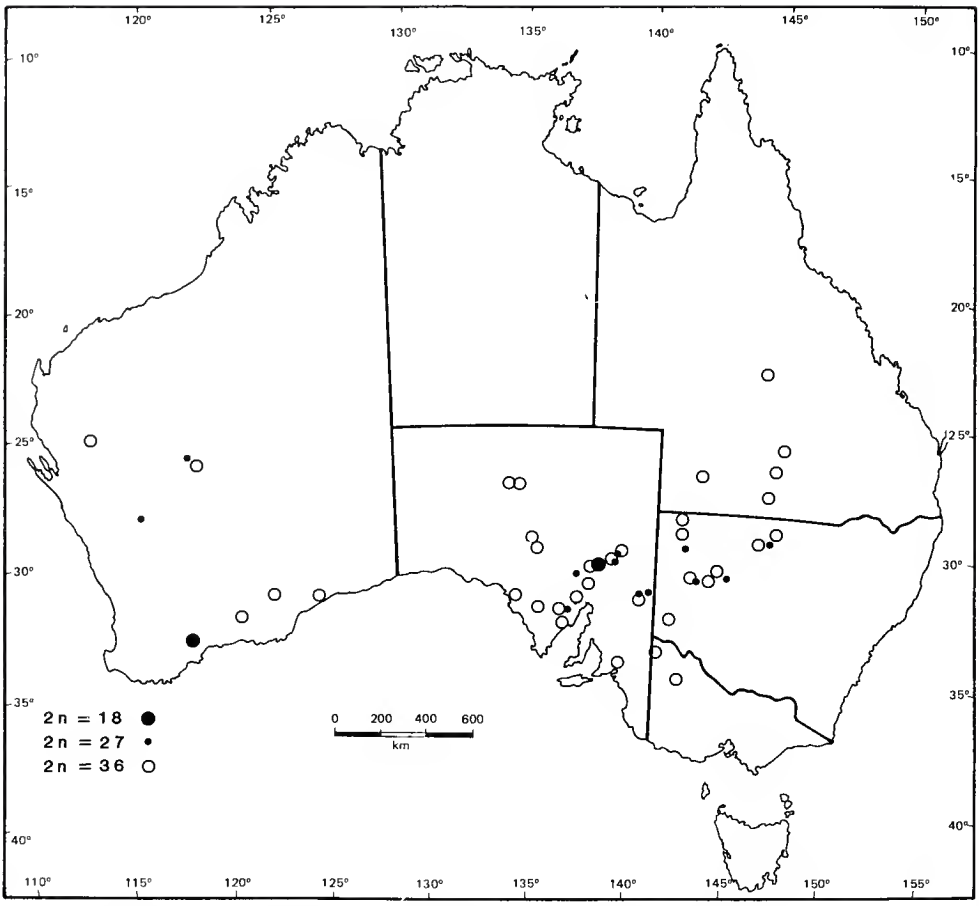


Fig. 2. Distribution of populations of *B. ciliaris* of known chromosome number.

similar to *B. lineariloba* but is readily distinguishable from the latter on the bases of its pronounced stem development, its curved fruits, and its conical rather than hemispherical fruiting heads'. Subsequently Watanabe *et al.* (1976) recorded that hybridization was possible between '*B. campylocarpa* (n = 4)' and several members of the *B. lineariloba* complex. Khyos *et al.* (1977) and Watanabe & Smith-White (1987) further discussed the affinities of the taxa in papers concerning relationships and phylogeny of the *B. lineariloba* complex.

Herbarium studies of members of this complex are incomplete. However, some type specimens, and extant voucher specimens used by Smith-White *et al.* (1970) have been examined. There is no doubt that the taxon referred to as '*B. campylocarpa* (sp. A, n = 4)' is *B. eriogona*, a species widespread in northern South Australia. This species is characterised by strongly curved, brown fruit in which the margins of the more or less entire wings are ciliate throughout their length.

B. campylocarpa s. str. occurs in SW Queensland and NE South Australia, extending south to at least Maree and Mt Lyndhurst. The mature fruit of this species are curved, dark brown to black, and have prominently lobed wings, each lobe having a few long hairs. Their voucher specimens lack mature fruit, which are desirable for positive identification, but it appears that '*B. campylocarpa* (sp. B,

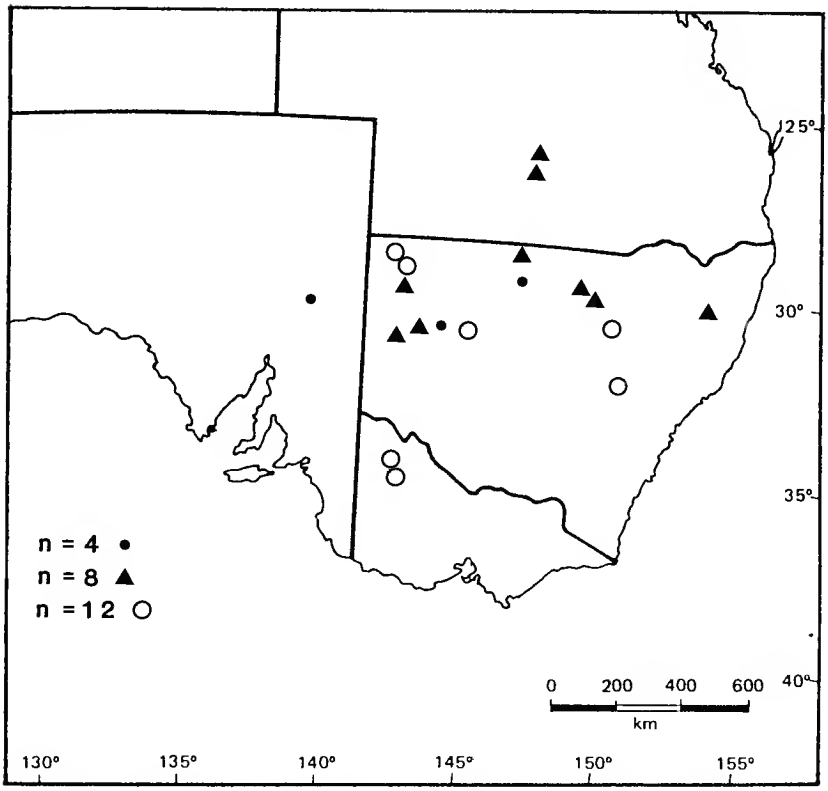


Fig. 3. Distribution of populations of *B. dentata* of known chromosome number.

Table II. Percentage pollen sterility in *Brachyscome*

B. ciliaris (Labill.) Less. complex
Short 3352, 3575, 3582, 3671, 3698 (all *c.* 100%)
Short 3556 (range 56–100%), *Short 3643* (75–100%)

B. curvicarpa
Short 3554 (0–9%, 11 of 15 plants showed no sterility)
**Short 3554* (0.9%), *Short 3549* (0.9%), *Short 3633* (9%)

B. aff. **curvicarpa** (yellow rays)
Short 3155 (20–41%), *Short 3587* (0–72%)
**Short 3587* (9.5%), *Short 3597* (12.6%)

B. dentata Gaudich.
Short 3755 (0–37%; n = 4), *Short 3650* (0–34%; n = 8) and *Short 3626* (0–77%; n = 12)

B. tetrapterocarpa
Short 3609 (0–49%), *Short 3611* (0–21%)
**Short 3609* (2.4%), *Short 3611* (0.9%)

* Pollen stained with aceto-carmine. (Other results are from phloxine/methyl green double stain.)

n = 5)', recorded by Smith-White *et al.* (1970) from William Creek, is *B. campylocarpa s. str.*

The further species recognised by Smith-White *et al.*, '*B. campylocarpa* (sp. C, n = 6)', has also been re-examined. Smith-White *et al.* recorded the frequent occurrence of rings or chains of four and suggested that the species may have a

basic x = 3. This is the case. We have now recorded n = 3 (*Short 3566*), as well as n = 6 (*Salkin s.n.*, *Short 3557*), and the respective voucher specimens are morphologically indistinguishable. This common species, referred to in Table I as *B.* sp. aff. *campylocarpa*, is found in arid areas of southern Queensland and New South Wales. The limited data suggest that diploids are found in the north of the range, our report being for specimens gathered near Barringun in Queensland. All tetraploids have been reported from New South Wales, collections having come from the vicinity of Booligal, Bourke, Brewarrina, and Menindee (Smith-White *et al.*). The species has curved, brown to almost black mature fruit. A prominent, ciliate wing is developed in the upper, curved portion of the fruit and there are two prominent tufts of hair at the base of the fruit.

Brachyscome ciliaris Complex

Brachyscome ciliaris is usually readily distinguished from all other brachyscomes as it is the only one which has heteromorphic fruit, cypselas of the ray florets being non-winged, those of the disc florets having a prominent wing. Within the species Davis (1948) recognised four varieties, i.e. var. *ciliaris*, var. *lanuginosa* (Steetz) Benth., var. *lyrifolia* and var. *subintegrifolia* G. L. Davis. Subsequently Davis (1964) reported that both var. *ciliaris* and var. *lanuginosa* were agamospermous and displayed the *Antennaria*-type of diplospory. De Jong (1963) reported var. *ciliaris* to be diploid with n = 9. Turner (1970) recorded both var. *ciliaris* and var. *lanuginosa* to be tetraploid and presumably apomictic. Smith-White *et al.* (1970) and Carter (1978a) reported 2x, 3x, 4x, 6x and 9x for *B. ciliaris*. Except for var. *lyrifolia* Carter refrained from applying any of the varietal names available. He also recorded that diplospory was supported by the cytological observations, i.e. the failure of some plants to enter meiosis at all, with disintegration of the pollen mother cells, or virtually complete asynapsis and a failure to finish meiotic division. All polyploids examined by Carter were pollen sterile. Only diploid var. *lyrifolia* from the Flinders Ranges, South Australia and a different diploid entity from the Ongerup region in Western Australia were found to exhibit regular pollen formation. Carter further noted that ploidy levels do not necessarily correspond to the morphological varieties formally recognised by Davis.

We also observed severe male meiotic irregularities in most members of this complex. Their apomictic nature is also reflected in the estimates of percentage pollen sterility for various populations (Table II).

Our observations on the morphological variation exhibited within *B. ciliaris* are in agreement with Carter's observations. In eastern Australia it is not uncommom to find two very different forms growing together. Comparatively more robust, clearly perennial plants with wholly or partly white, cottony stems are frequently found growing with less robust, probably annual plants which have reddish-brown, often glandular pubescent stems. Following Davis, members of the former group are referrable to var. *lanuginosa*, the latter to var. *ciliaris*. However, closer examination reveals that specimens referrable to both var. *lanuginosa* and var. *ciliaris* may exhibit considerable variation in features such as leaf shape, the type and extent of the indumentum on the stem, leaves and bracts, and in fruit morphology. The same is true for Western Australia, where the morphological variation seems more complex than in the east. Clearly, the recognition of the aforementioned varieties is artificial, their circumscription being based on features which are readily apparent, but not consistent, for circumscribing taxa.

We have also found that morphologically identical populations may exhibit different ploidy levels, e.g. *Short 3630 & 3645* (n = 27I or 2n = 27) and *Short 3556 & 3643* (n = 36I or 2n = 36).

Within the *B. ciliaris* complex variation is such that attempts at delimitation may prove to be an impracticable exercise and, as discussed by authors such as Löve (1960) and Stebbins (1971), for an apomictic, polyploid group it may not be

necessarily desirable to formally describe and name taxa. *Brachyscome ciliaris* var. *brachyglossa* Gauba (Gauba 1948), published soon after the revision by Davis (1948) is an example where the formal naming of an entity is not justifiable. The key attribute of this variety is the possession of reduced ray florets. However, specimens with reduced rays have a sporadic occurrence in populations which are otherwise morphologically distinct from one another. For example, *Short 3758* is vegetatively distinct from the type specimen of var. *brachyglossa* but has reduced ray florets. There can be no doubt that specimens with reduced ray florets are mutant forms undeserving of formal recognition.

With the exception of var. *lyrifolia*, no attempt has been made in Table I or Fig. 2 to assign collections to the varieties recognised by Davis.

The distribution of diploid and higher ploid entities of *B. ciliaris* illustrated in Fig. 2 incorporates our data plus that provided by Turner (1970), Smith-White *et al.* (1970) and Carter (1978a). Turner's unnamed collection, *Turner 5266*, belongs to this complex. Although vouchers pertaining to Carter's paper seem to be no longer extant it is unlikely that his chromosome determinations would pertain to any other species. However, we have excluded the determinations of 6x and 9x recorded by him. We found no evidence of such numbers and Carter has since indicated that they are likely to be erroneous (Dr Carolyn Leach, pers. comm. 1991). The distribution pattern is similar to that often found in apomictic, polyploid complexes, i.e. the sexual diploids have restricted distributions, the apomictic higher ploids, in this case 3x and 4x, are widely distributed and frequently occur in disturbed habitats such as roadsides (e.g. Stebbins 1971, Watanabe 1986).

Brachyscome debilis

Smith-White *et al.* (1970) noted that the karyotype of *B. debilis* and *B. leptocarpa* F. Muell. were similar and further suggested that the presence or absence of a wing on the mature fruit, the only means of distinction, may have a simple genetic determination. This has not been experimentally tested but both entities are frequently found growing together. If they prove to be conspecific then *B. debilis*, the earlier name (and with unwinged fruit), has priority.

It was not possible to decide from the bud material of *Short 3916* whether the chromosome number determination was referable to *B. debilis* or *B. leptocarpa* and mature plants from the same population gathered in November 1990 revealed that both entities were present. Unfortunately it was not noted whether subsequent determinations of $2n = 6$ were from root tips emergent from winged, or unwinged, fruit.

Brachyscome dentata Complex (including *B. chrysoglossa*, *B. curvicarpa*, *B.* aff. *curvicarpa*, *B. papillosa* & *B. tetrapterocarpa*)

Davis (1948) adopted the name *B. marginata* Benth. for a species which is 'very variable in vegetative characters' but with fruit 'relatively constant in character' (Davis *l.c.*, pp. 189, 190). Within the species she recognised two varieties, var. *marginata* and var. *chrysoglossa* (F. Muell.) Davis, the latter having 'orange-yellow' ray florets but otherwise said to be identical to the white-rayed var. *marginata*. The name *B. marginata* was also used by Smith-White *et al.* (1970) whereas others (e.g. Eichler 1965; Cooke 1986) adopted the name *B. heterodonta* DC., a name previously, and incorrectly, cited by Davis as a synonym of *B. marginata*. However, Burbidge (1982) found *B. dentata* Gaudich. to be the earliest legitimate name available for members of this complex and it is adopted here.

In the key to species, which is based on differences in fruit morphology, the winged fruit of this taxon were described by Davis as having a body with short glandular hairs or finger-like, cylindrical tubercles. The fruit wing was found to be completely and irregularly dissected. We, and presumably Smith-White *et al.*, used these features to determine a name for the voucher collections, all of which

have white ray florets, and therefore fit Davis's concept of '*B. marginata* var. *marginata*'. However, as with Davis, we note that specimens may be vegetatively quite variable. It should also be noted that the hairs on the body of the fruit are apparently eglandular, not glandular as indicated by Davis.

In their paper Smith-White *et al.* (1970) reported chromosome number determinations of n = 4, 8, 9 and 12 for this species. In view of a supposed close affinity of *B. dentata* and the *B. aculeata* (Labill.) Less. group, the latter with x = 9, they were not convinced that the higher numbers were polyploid derivatives. However, determinations of n = 9 for several collections are likely to have been due to the presence of B chromosomes, of which one or more are frequently found in this species. They are large (the largest so far detected in any species of *Brachyscome*), being nearly the same size of autosomes, and metacentric. There is no evidence of pairing affinity with chromosomes of the normal complement although two B chromosmes can pair with each other at diakinensis and metaphase I. Stace (1981) has also noted that the Carlton Bay (Tasmania) collection with n = 9 that was attributed to *B. dentata* by Smith-White *et al.* is in fact *B. sieberi* DC. var. *gunnii* DC., a member of the *B. aculeata* group. Thus, there can be no doubt that this is a polyploid sequence based on x = 4.

According to Davis (cited in Smith-White *et al.* 1970), in the Armidale district of New South Wales, *B. dentata* is, or may be, a facultative apomict. No evidence was presented to support this statement. Although it may be correct it is generally at variance with our findings. In this study all of the plants examined, including tetraploids and hexaploids which frequently formed a single quadrivalent, displayed reasonably regular male meiosis. The formation of seemingly good pollen was observed. Estimates of pollen sterility obtained (Table II) suggest that this is not always the case but florets displaying no pollen sterility were found in each population and high estimates of percentage pollen sterility were rare: 18 of the 45 individual florets examined for this species displayed no pollen sterility, and a further 9 exhibited less than 5% sterility. It was also found that isolated, tetraploid plants grown in the greenhouse did not set seed. These observations suggest that, at least for most of its range, *B. dentata* is a sexual outbreeder.

It is evident from herbarium specimens that there are not only problems with the circumscription of *B. dentata* but also with *B. curvicarpa*, *B. papillosa* and *B. tetrapterocarpa*, all taxa with x = 4. For example, *Corrick 7332* displays fruit similar to that usually attributable to typical *B. dentata* but has a leaf morphology resembling the more typical form of *B. papillosa*. Furthermore, *B. curvicarpa*, as circumscribed by Davis (1948), is an exceedingly variable taxon in relation to fruit colour and morphology, leaf morphology, and the colour of the ray florets (white or yellow). Vegetatively, many collections with the typical fruit of *B. curvicarpa* are not dissimilar to *B. dentata*. It has also been noted that, were it not for the four-winged fruit, *B. tetrapterocarpa* would probably be indistinguishable from typical *B. curvicarpa*.

Cytological observations in *B. curvicarpa*, *B.* aff. *curvicarpa* and *B. tetrapterocarpa* were mainly made at diakinensis or metaphase I. The chromosomes displayed regular pairing but univalent B chromosomes were often found in *B.* aff. *curvicarpa* (yellow rays) and *B. tetrapterocarpa*. Smith-White *et al.* (1970, fig. 53, voucher not seen) have also recorded B chromosomes for *B. curvicarpa s. str.* although they were not observed by us, which may reflect the small sample of pollen mother cells examined. In contrast to *B. dentata*, the B chromosomes found in all three of the aforementioned taxa are minute and distinct from the chromosomes of the normal complement.

Populations of the aforementioned taxa were tested for pollen sterility (Table II) using both double stain and aceto-carmine. All such staining methods are only an estimate of sterility and adverse environmental conditions can affect pollen development. This may explain why, with the double stain method, marked variation in percentage pollen sterility was sometimes found between individuals of the one population, e.g. in *Short 3554* eleven of the 15 individuals displayed no

sterility but in one floret a value of 9% sterility was obtained. It is also noticeable that results from staining with aceto-carmine suggest lower levels of sterility although this may reflect the smaller sample and different method of sampling. Despite these problems with the interpretation of data the observations suggest that pollen sterility may be associated with the presence of B chromosomes. With the exception of *Short 3633* (*B. curvicarpa*), an increase in the percentage of sterile pollen grains tended to correlate with an increase in the number of pollen mother cells observed to have B chromosomes.

The specimens referred to above as *B.* aff. *curvicarpa* (yellow rays) are not the same as *B. marginata* var. *chrysoglossa*. Specimens referred to the former taxon have fruit resembling those of typical *B. curvicarpa*. The combination to accomodate var. *chrysoglossa* under *B. dentata* is also wanting. Because of the problems in circumscribing taxa the combination is not made here. At least for the time being we suggest that the name *B. chrysoglossa* F. Muell. be adopted, as in Ross (1990), for this taxon.

Figure 3 displays the distribution of populations of *B. dentata* (*sensu B. marginata* var. *marginata* of Davis) of known chromosome number, incorporating our data and that of Smith-White *et al.* (1970). It shows that the tetraploids and hexaploids are more widely distributed than the diploids which are only known from a few isolated localities. Again, this is consistent with the distribution pattern that is frequently observed in polyploid taxa. However, the poor delimitation of this taxon and its obvious close affinities with the aforementioned group of species should not be forgotten. If chromosome data for the entire *B. dentata* complex were incorporated in the figure then diploids would be found to be the most widespread.

Brachyscome diversifolia Complex (including *B. goniocarpa*, *B. gracilis* & *B. readeri*)

The collection *Short 3345*, here tentatively attributed to *B. diversifolia* var. *diversifolia*, 2n = 24 would appear to be a hexaploid with a base of x = 4. Three other levels, 2x, 8x and 10x have been reported for this variable species (Smith-White *et al.* 1970).

Smith-White *et al.* (1970) reported n = 3 for *B. goniocarpa*. However, more recent work has revealed that *B. goniocarpa s. str.*, a species with inconspicuous ray florets, and restricted to Western Australia, South Australia and western Victoria, has n = 4.

The name *B. goniocarpa* has been misapplied in Queensland and New South Wales to at least two distinct entities. Much of the material from southern New South Wales is apparently of another closely related species, *B. gracilis*, whereas the records of n = 3 by Smith-White *et al.* seemingly apply to an undescribed taxon referred to herein as *B.* sp. aff. *goniocarpa*. In the latter taxon at least the outer fruit in each capitulum are characterised by having a prominent knob-like projection at the apex.

Herbarium specimens suggests that, as defined by Davis, *B. readeri* may prove to constitute two taxa which have similar fruit but differ vegetatively. One of these, i.e. *B. readeri s. str.*, is confined to south-west Victoria and south-east South Australia, the other is confined to north-west Victoria and adjoining areas in New South Wales. Further work is required to substantiate this view and *Short 3917* is here referred to *B. readeri*.

There can be little doubt that taxa referred to this complex, i.e. *B. diversifolia* (x = 4), *B. goniocarpa* (n = 4, 2n = 8), *B.* sp. aff. *goniocarpa* (2n = 6), *B. gracilis* (2n = 8), *B.* aff. *gracilis* (2n = 24), and *B. readeri* (2n = 10) are closely related to each other. However, the complex is not readily delimited from some other species groups. Experimental hybridization work (Watanabe *et al.* 1992) suggests a close relationship of *B. goniocarpa* and *B. dichromosomatica* (a member of the *B. lineariloba* complex) and, as noted by Davis (1955), the fruit morphology of *B. gracilis* suggests a strong affinity with *B. campylocarpa s. str.*

Brachyscome iberidifolia Complex

Herbarium material referred to by various botanists as *B. iberidifolia* exhibits considerable vegetative and floral diversity but is as yet unsorted. Sharma & Murty (1977) have previously noted that the species is a casual apomict and this may partly explain the observed variation. *B. bellidioides* Steetz, *B. exilis*, *B. eyrensis* G.L. Davis and *B. pusilla* Steetz are all closely related and the circumscription of each of these species is also problematic. In this paper, of the aforementioned species, only *B. exilis* is recognised as a distinct entity, all other collections being referred to *B. iberidifolia s. lat.*

All members of this group so far examined exhibit a haploid number of n = 9 (De Jong 1963, Carter 1978a).

Brachyscome lineariloba Complex (including *B. breviscapis* & *B. dichromosomatica*)

Smith-White *et al.* (1970) recognised five unnamed species within *B. lineariloba* (sp. A, n = 2; sp. B, n = 6; sp. C, n = 8; sp. D, n = 4; sp. E, 2n = 10). Further work, pertaining to such features as the frequency of B chromosomes, race relationships and meiosis in natural hybrids, was carried out (e.g. Watanabe *et al.* 1975, Khyos *et al.* 1977) and subsequently Carter (1978b) formally recognised 'sp. A' as *B. dichromosomatica* and 'sp. D' as *B. breviscapis*. The remaining three 'species' proved to be morphologically indistinguishable and were treated as cytodemes B, C and E within *B. lineariloba*. The distribution of the various cytodemes, as presented by Kyhos *et al.* (1977) and Carter (1978b), are confirmed by the data presented in Table I.

Surprisingly the karyotype obtained for the Western Australian collection, *Short 3819*, of cytodeme C (2n = 16) is identical with that of Variant V_{17} (C_1) which until now has only been found in New South Wales (east of the Darling River localities 1, 2 & 3; see Watanabe *et al.* 1985). It differs from the standard C_1 in having a longer short arm of the satellited 3 and 4 chromosomes. In Watanabe *et al.* (1985) plants with this karyotype were in the minority and this variant (V_{17}) was regarded as being derived from the majority 'standard' karyotype.

Brachyscome oncocarpa Complex (including *B. cheilocarpa*, *B. ciliocarpa* & *B. halophila*)

Currently four species are generally recognised within the complex, i.e. *B. cheilocarpa* F. Muell, *B. ciliocarpa*, *B. halophila* and *B. oncocarpa*. This complex is most distinct, each constituent taxon so far examined having fruit with two large secretory canals in the pericarp, a feature which, at least in combination with the lack of terminal anther appendages, is unique to this group. However, the component taxa, named and unnamed, are not always so clearly delimited. Preliminary sorting of herbarium specimens has revealed the existence of several distinctive, unnamed taxa of uncertain rank. Each of these tends to have a limited geographical range and they differ from each other in fruit morphology and/or the vestiture of the leaves, scapes and bracts. The true application of the names *B. ciliocarpa* and *B. clementii* Domin are also yet to be ascertained. In keeping with current usage, in this paper the name *B. ciliocarpa* is used for the eastern Australian collection, *Short 3607*. The name is, however, likely to be either reduced to synonymy under *B. oncocarpa* or, if retained, apply to a western taxon.

Brachyscome rara

Until recently this species was only known by the type collection from southwest Queensland. It has since been established that the name *B. coongiensis* Munir is synonymous and that *B. rara* is probably restricted to the Cooper River drainage basin (Short 1990). Its affinities are seemingly with *B. basaltica* F. Muell. var. *gracilis* Benth., also n = 6.

ACKNOWLEDGEMENTS

Research was partly supported by grant no. 02640540 from the Ministry of Education, Culture and Scientific Research, Japan , and by an Australian Biological Resources Study Grant. Emeritus Professor S. Smith-White gave freely of his knoweldge of some field locations. Paul Ronan and Sharee Stringer, employed by the ABRS grant, provided the data on pollen sterility. David Albrecht and Neville Walsh kindly collected living material for cultivation at the Royal Botanic Gardens, Melbourne, and Alf and Esma Salkin donated seed of several taxa.

REFERENCES

Burbidge, N. T. (1982). A revision of *Vittadinia* A. Rich. (Compositae) together with reinstatement of *Eurybiopsis* DC. and description of a new genus, *Camptacra*. *Brunonia* 5: 1–72.

Carter, C. R. (1978a). The cytology of *Brachycome*. II. The subgenus *Metabrachycome*: a general survey. *Aust. J. Bot.* 26: 699–706.

Carter, C. R. (1978b). Taxonomy of the *Brachycome lineariloba* complex (Asteraceae). *Telopea* 1: 387–393.

Cooke, D. A. (1986). *Brachycome* Cass. *In* Jessop, J. P. & Toelken, H. R. *Flora of South Australia*. 4 ed. Pt. III. (Govt. Printer: Adelaide.) pp. 1445–1458.

Davis, G. L. (1948). Revision of the genus *Brachycome* Cass. Part. I. Australian species. *Proc. Linn. Soc. New South Wales* 73: 142–241.

Davis, G. L. (1955). Supplementary notes on the genus *Brachycome* Cass. *Proc. Linn. Soc. New South Wales* 79: 203–210.

Davis, G. L. (1964). Embryological studies in the Compositae. IV. Sporogenesis, gametogenesis, and embryogeny in *Brachycome ciliaris* (Labill.) Less. *Aust. J. Bot.* 12: 142–151.

De Jong, D. C. D. (1963). Documental chromosome numbers in plants. *Madrono* 17: 116–117.

Eichler, H. (1965). 'Supplement to J. M. Black's Flora of South Australia'. (Govt Printer: Adelaide.) *Brachyscome heterodonta*, p. 298.

Gauba, E. (1948). Contributions to the Flora of South Australia — III. *Victorian Nat.* 65: 183–186.

Kyhos, D. W., Carter, C. R. & Smith-White, S. (1977). The cytology of *Brachycome lineariloba*. 7. Meiosis in natural hybrids and race relationships. *Chromosoma (Berlin)* 65: 81–101.

Löve, A. (1960). Biosystematics and classification of apomicts. *Feddes Rep.* 63: 136–149.

Owczarzak, A. (1952). Pollen grains — a rapid method of mounting. *Stain Technol.* 27: 249–253.

Ross, J. H. (1990). 'A census of the vascular plants of Victoria'. (3rd ed.) (Conservation, Forests & Lands: Victoria.)

Sharma, H. P. & Murty, Y. S. (1977). Embryological studies in the Compositae 3. Tribe Astereae, *Brachyscome iberidifolia* Benth. a casual apomict. *J. Indian Bot.* 56: 321–328.

Short, P. S. (1990). A note on *Brachyscome rara* G. L. Davis (Asteraceae). *J. Adelaide Bot. Gard.* 13: 63–64.

Smith-White, S., Carter, C. R. & Stace, H. M. (1970). The cytology of *Brachycome*. I. The subgenus *Eubrachycome*: a general survey. *Aust. J. Bot.* 18: 99–125.

Stace, H. M. (1981). Biosystematics of the *Brachyscome aculeata* (Labill.) Less. sensu G. L. Davis species complex (Compositae: Astereae). *Aust. J. Bot.* 29: 425–440.

Stebbins, G. L. (1971). 'Chromosome evolution in higher plants'. (Edward Arnold: London.)

Turner, B. L. (1970). Chromosome numbers in the Compositae. XII. Australian species. *Amer. J. Bot.* 57: 382–389.

Watanabe, K. (1986). The cytogeography of the genus *Eupatorium* (Compositae) — A review. *Pl. Sp. Biol.* 1: 99–116.

Watanabe, K., Carter, C. R. & Smith-White, S. (1975). The cytology of *Brachycome lineariloba*. 5. Chromosomes and relationships and phylogeny. *Chromosoma (Berlin)* 52: 383–397.

Watanabe, K., Carter, C. R. & Smith-White, S. (1976). The cytology of *Brachycome lineariloba*. 6. Asynchronous chromosome condensation and meiotic behaviour in *B. lineariloba* A (n = 2) x *B. campylocarpa* A (n = 4). *Chromosoma (Berlin)* 57: 319–331.

Watanabe, K., Carter, C. R. & Smith-White, S. (1985). The cytology of *Brachycome lineariloba* 9. Chromosomal heterogeneity in natural populations of cytodeme C (2n = 16). *Canad. J. Genet. Cytol.* 27: 410–420.

Watanabe, K., Short, P. S., Kosuge, K. & Smith-White, S. (1992). The cytology of *Brachyscome* Cass. (Asteraceae: Astereae). II. Hybridization between *B. goniocarpa* (n = 4) and *B. dichromosomatica* (n = 2) *Aust. J. Bot.* 39(5):475–478.

Watanabe, K. & Smith-White, S. (1987). Phyletic and evolutionary relationships of *Brachycome lineariloba* (Compositae). *Pl. Syst. Evol.* 157: 121–141.

Manuscript received 2 May 1991; revised version received 2 July 1991.

ALPINE BOTANICAL EXPEDITIONS OF FERDINAND MUELLER

by

LINDEN GILLBANK*

ABSTRACT

Gillbank, Linden, Alpine botanical expeditions of Ferdinand Mueller. *Muelleria* 7(4): 473–489 (1992). — Victoria's first Government Botanist, Ferdinand Mueller, directed his first three official field trips towards Victoria's alps. In providing the earliest botanical surveys of the region, Mueller's mid-nineteenth century expeditions were important for phytogeography and plant taxonomy. They also constitute an important episode in Australia's botanical history.

INTRODUCTION

The Historic Places Section of Victoria's Department of Conservation & Environment initiated a project on the heritage of Victoria's alps. As the author of the flora and fauna section of that project, I have attempted to follow the botanical footprints of a succession of observers across the region — the first being the Colony of Victoria's first and long-serving Government Botanist, Dr Ferdinand Mueller. Thanks to Mueller, the region has almost as long a scientific as a pastoral history. By 1860 Mueller had laid firm taxonomic foundations for the flora of Victoria's alps and had cemented Victoria's alps into the very foundations of Victoria's botanical history.

This paper describes Mueller's mid-nineteenth century botanical exploration of Victoria's high country. Where appropriate I have used Mueller's own words. In these quotations I have left names as he spelt them.

The Colony of Victoria's civic-minded first governor, Charles La Trobe, created the position of Government Botanist and on 26 January 1853 appointed Dr Ferdinand Mueller to it. While plant collections had previously been made from other parts of the colony, the flora of Victoria's alps still awaited botanical investigation. Mueller responded to this geographical gap in colonial botanical knowledge with a sense of urgency and fascination. Right from his appointment he was determined to botanically explore the region and describe its flora. With some encouragement and support from Sir William Hooker, then director of the Royal Botanic Gardens at Kew, Mueller proceeded to overcome inclement weather and unknown geography to realize this particular ambition — an essential prerequisite for any published flora of the colony.

During his first decade as Government Botanist Mueller made seven journeys into the high country, four of them of great botanical significance. Although his first three major botanical expeditions in Victoria all targetted the alps, it was not until his third expedition that he managed to reach the heart of Victoria's alps.

Mueller's reports and correspondence are primarily botanical and, with few exceptions, include scant details about the routes followed and the people who provided him with accommodation, directions and company. Consequently it is difficult to reconstruct his precise routes and to determine where he was trailblazing and where he was following in the footsteps of miners or stockmen. Certainly in parts of Victoria's alps Mueller was exploring uncharted country. In order to map the physiography and flora he recorded geographical as well as botanical information and named plateaux as well as plants. Mueller's botanical interests extended beyond the discovery and naming of plants. He was interested in where

* History and Philosophy of Science Department, University of Melbourne, Parkville, Victoria, Australia 3052.

they grew — their habitats and geographic distributions — as well as their taxonomic positions. As he documented the flora of Victoria's alps, he was keen to compare it with that of other regions — the alps of Tasmania, New Zealand and South America and also other less-elevated parts of continental Australia. Mueller was an example *par excellence* of the nineteenth century phytogeographer.

Also typical of his times was Mueller's pragmatic interest in plants — he was forever on the lookout for new useful plants. Plants of medicinal, food or timber value were of economic interest to the colony and mother England. With a broad appreciation of the landscape, Mueller was also interested in the agricultural, pastoral and mining potential of the alps and in possible access routes.

First Expedition — Buffalo and Buller

On top of his agenda as Government Botanist was the botanical exploration of Victoria's alps. On the 29th of January 1853, only three days after his appointment, Mueller set off on horseback via the new Ovens goldfields 'on a botanical journey towards Mount Aberdeen and the alpine country near the Mitta Mitta' (Mueller to Lonsdale, 29 Jan. 1853). He was accompanied by Mr John Dallachy, the Superintendent of Melbourne's Botanic Gardens, who was collecting for the Gardens.

Four weeks later Mueller placed the first European foot on the summit of Mt Aberdeen (the Horn) on the Buffalo range. It was not a solo performance. His guide was the surveyor, Mr Barnett (Mueller to Lonsdale, 9 Mar. 1853). Mueller was pleased with his botanical findings. In his first annual report as Government Botanist, Mueller (1853: 3) recorded that:

> 'I ascended Mount Aberdeen and another peak more than 4,000 feet high, and examined the rich, almost tropical, vegetation which borders the rivers rising in these mountains. It was in this locality that our exertions were rewarded with the discovery of the high, majestic Grevillea Victoriae and other rarities.'

Mueller (1855b: 107) named this magnificent *Grevillea* 'surpassing in size and splendour all others in this colony' (Mueller to Lonsdale, 9 Mar. 1853) after 'Her Gracious Majesty the Queen'. Another mountain plant whose beauty impressed him was a species of *Correa*. Mueller (1853: 7) wanted to name it after Governor La Trobe. However he later realized that William Hooker had already named it *Correa Lawrenciana*. This illustrates the difficulty of identifying plants in a new environment so far from major botanical collections, libraries and other botanists. His names for the *Grevillea* and an *Acacia*, which Meuller (1858b:7) named after Dallachy, have endured. *Grevillea victoriae* and *Acacia dallachiana* (Fig. 1) can still be seen on Mt Buffalo, and Mueller's specimens are now the type specimens in Melbourne's National Herbarium. Seven of the 20 species Mueller collected on Mt Buffalo were new (Willis 1989).

It was March before Mueller and Dallachy descended to the Ovens River. The lateness of the season and the condition of their horses prevented their reaching the higher alpine country. Instead Dallachy took living specimens of attractive ornamental plants, including the beautiful species of *Grevillea* and *Correa*, straight back to the Botanic Gardens in Melbourne, while Mueller proceeded alone to Mt Buller (Mueller to Lonsdale, 9 Mar. 1853).

Mt Buller had not previously been botanically explored. There Mueller hoped to observe Victoria's genuine alpine flora. He was not disappointed.

> 'I was delighted to observe here for the first time, this continent's Alpine vegetation which in some degree presented itself as analogous with the Alpine Flora of Tasmania (Ranunculus Gunnianus, Euryomyrtus alpina, Celmisia astelifolia, Gentiana Diemensis, Podocarpus montana, Trisetum antarcticum, &c.), and which was by no means destitute of its own peculiar species (Phebalium podocarpoides, Goodenia cordifolia, Hovea gelida, Oxylobium alpestre, Brachycome nivalis, Anisotome glacialis, &c.). Remarkably enough, only one of these exhibits any similarity to the

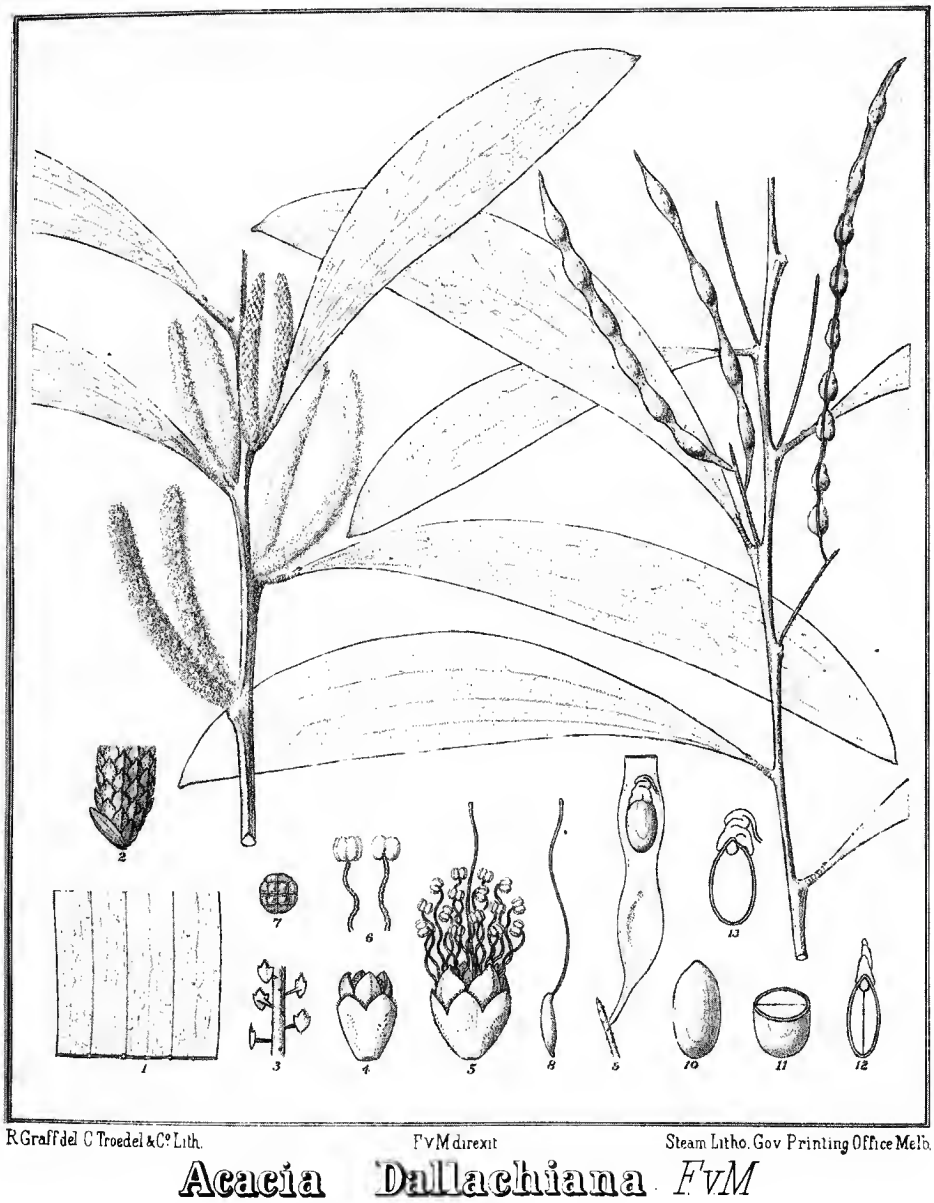


Fig. 1. *Acacia dallachiana* reproduced from *Australian species of Acacia and cognate genera*, F. Mueller (1888)

singular subalpine forms discovered by Sir Thomas Mitchell on the Australian Grampians' (Mueller 1853: 3).

Of the 26 species Mueller collected on Mt Buller eight were new (Willis 1989).

After investigating the flora of the adjacent ranges Mueller travelled down the Goulburn River and up King Parrot Creek. Disappointed at not reaching the alps near the Mitta Mitta, Mueller decided to explore parts of the Gippsland alps. However he was again thwarted. Floods from recent inundating rains prevented his reaching the Baw Baw mountains. Fearing that alpine plants would have finished flowering before he reached them, Mueller lowered his sights and turned

instead toward the coastal flora, whose flowering season was less restricted. An extensive trek through Gippsland completed his five month, 1,500 mile, first official field trip (Mueller 1853, Barnard 1904, Daley 1924).

Not surprisingly Mueller's first annual report was devoted almost entirely to his extensive field trip and the botanical information he derived from it. Many new species could now be added to the flora of the Colony of Victoria and to the flora of continental Australia. Mueller listed about 1,000 species of plants indigenous to Victoria (Mueller 1853: 4).

Mueller's first glimpse of Australia's high country revealed several plants with culinary and medicinal possibilities. His report was full of hope. Could a thick-rooted Gentian be used instead of its European cousin as a tonic or in the treatment of fevers? Was the bitterness of several plants indicative of medicinal properties?

> 'The bark of Tasmania aromatica appears to me to possess the medicinal power of the Wintera bark, gathered from a similar tree in Tierra del Fuego; and its fruit is allied to that of the North American Magnoliae used in cases of rheumatism and intermittent fever . . .
>
> The bark of the Australian Sassafras tree (Atherospermum moschatum) has already obtained some celebrity as a substitute for tea; — administered in a greater concentration, it is a diaphoretic, as well as diuretic, and has for this reason already been practically introduced to medicine by one of our eminent physicians . . .
>
> Baeckea utilis, from Mount Aberdeen, might serve travellers in those desolate localities as tea, for the volatile oil of its leaves resembles greatly in taste and odour that of lemons not without a pleasant, peculiar aroma . . .
>
> Anis[o]tome glacialis — a large-rooted umbelliferous plant, from the snowy top of Mount Buller — will be added, perhaps, hereafter, to the culinary vegetables of the colder climates' (Mueller 1853: 6).

This prospective vegetable was later named *Aciphylla glacialis* (Bentham 1867: III, 375). Because of its fleshy stem, this member of the Apiaceae is commonly called Mountain Celery. Unfortunately cattle also like it and it has suffered accordingly.

Mueller's first trip is botanically important not only for the new information it revealed and the economic hopes it inspired. It also established new collections and connections. Dried specimens collected during that trip constituted the primordium of Victoria's National Herbarium. Included were the specimens used by Mueller to name taxa, specimens which were later called type specimens. Mueller sent duplicate specimens with their descriptions and notes on habitat and geographic range to Sir William Hooker at the Royal Botanic Gardens at Kew, which was already the repository for many type specimens of Australian plants.

On the fifth day of his expedition Mueller penned his first letter to Sir William Hooker, announcing his appointment as Government Botanist (Cohn 1989, Maroske and Cohn 1992) and intimating his intention of describing the flora of Australia. He proposed a mutual interchange of specimens and asked for assistance in the revision and publication of manuscripts (Kew Correspondence v.74, 135). Thus was begun the vast correspondence between the Botanical Gardens at Melbourne and Kew. In order to have his work read and recognized, Mueller was pleased to have his letters to Hooker and his government reports published in *Hooker's Journal of Botany and Kew Garden Miscellany*. It was the original place of publication for some of his botanical discoveries.

Second Expedition — Cobberas

In August 1853, before submitting his first report, Mueller wrote to the Colonial Secretary seeking permission to further botanically explore the colony including the alps. An assistant, three horses and a barometer were required

(Mueller to Forster, 22 Aug. 1853). Before the end of his first year as Government Botanist, Mueller was well into his second journey of botanical exploration and was again approaching Victoria's alps. After collecting in the Grampians and other parts of western Victoria during November and December 1853, he travelled along the Murray to Torrumbarry where early in January Mueller (1854a) wrote to Hooker:

> 'My main harvest of new, and I hope also ornamental plants, will be likely in the Alps to which I am now proceeding; and for the investigation of some prominent points, I shall devote the favourable months of February and March, and, if the weather becomes not too inclement, also April next.'

In his reply Hooker noted with pleasure that:

> 'you are en route for the Alps, the very locality that I lately suggested to your new Governor, Sir Chas. Hotham, as certain to yield the most interesting flora, or one that must be very instructive for botanical geography. He has promised to do all in his power to promote the cause of Botany, and to place you and me in frequent communication' (Hooker to Mueller, 9 Apr. 1854).

In January 1854, probably following the tracks of a succession of gold miners along George Gray's stock route, Mueller travelled up the Mitta Mitta valley, across the Gibbo Range, back to the Mitta Mitta and on to Omeo. Again he was prevented from reaching the colony's highest peaks. Extensive bushfires raging in the intermediate mountains prevented his visiting the Bogong mountains, whose summits Mueller (1854b: 4) reported to be 'covered with eternal snow and glaciers'. And so Mueller turned east toward the rugged Cobberas mountains and the adjacent plateaux.

> 'The valleys are either covered with spongy mosses (chiefly Sphagnum), which become transformed into peat, or produce nutritious grasses, some luxuriant enough to recommend their introduction into countries of the arctic zone — (Hierochloe antarctica, H. submutica, Agrostis frigida, A. nivalis, &c.) The vegetation of the Coborras [*sic*] Mountains does neither fully agree with that of Mount Buller, examined last year, nor with the Alpine Flora of Van Diemen's Land, although the following series of its plants may indicate its partial identity with both: — Ranunculus pimpinellifolius, R. scapiger, Geranium brevicaule, Acacia bossiaeoides, Hovea gelida, Oxylobium alpestre, Anisotome glacialis, Didiscus humilis, Celmisia astelifolia, Eurybia megalophylla, Brachycome nivalis, B. multicaulis, Ctenosperma alpinum, Ozothamnus Hookeri, O. cinereus, Antennaria nubigena, Senecio pectinatus, Goodenia cordifolia, Gaultheria hispida, Leucopogon obtusatus, Lissanthe montana, Richea drachophylla, Prostanthera rotundifolia, Euphrasia alpinia, Gentiana Diemensis, G. montana, Grevillea Australis, Pimelea gracilis, Podocarpus montana, Exocarpus humifusa, Juncus falcatus, Restio Australis, Oreobolus pumilio, Lomaria alpina, Polytrichum dendroides, &c.' (Mueller 1854b: 4)

The Cobberas vegetation was sufficiently different from that of Mts Buffalo and Buller to yield many species new to Mueller and to science. A third of the 59 species Mueller collected on the Cobberas were new (Wakefield 1969; Willis 1989). Mueller (1854: 4) recorded modestly that he 'had the gratification of adding several new species, probably peculiar to the Alpine Flora of Australia' and mentioned *Asterolasia trymalioides, Hierochloe submutica, Phebalium phylicoides* [which he named *P. phylicifolium*], *Eurybia* [which he renamed *Olearia*] *alpicola, Gnaphalium alpigenum* [now *umbricola*], *Agrostis gelida* [now *muelleriana*], *Mniarum singuliflorum* [now *Scleranthus singuliflorus*], *Centella* [now *Oschatzia*] *cuneifolia, Anisotome* [now *Aciphylla*] *simplicifolia, and Ozothamnus planifolius.* Other species for which Mueller's specimens from the Cobberas have become the

type specimens include *Pimelea alpina*, *Leucopogon maccraei*, *Brachyscome nivalis*, and *Olearia megalophylla* (Wakefield 1969). Mueller's names have endured for all four.

By a circuitous route including the Tambo and Snowy Rivers Mueller returned through Gippsland to Melbourne. His intention to scale Mt Wellington was thwarted by heavy rain (Mueller to Foster, 18 Apr. 1854). His horseback journey of 2,500 miles within six months had revealed almost 500 species new to Victoria, a quarter of which were new to science (Mueller 1854b: 5).

Third Expedition — Wellington but not Bogong

Mueller's third expedition in the summer of 1854/5 was his most important alpine expedition. As well as attempting the ascent of Mts Wellington and Bogong, Mueller also followed the alps across the border into NSW.

In a letter accompanying his second annual report, Mueller sought permission from his Excellency the Lieutenant Governor, Charles Hotham:

> 'that I might according to Sir William Hooker's desire extend my exploration over the whole alpine chain unrestricted to geographical boundaries, principly as the northern slope of the alps, within the borders of New South Wales' (Mueller to Foster, 9 Oct. 1854).

Mueller argued that, since Dr Joseph Hooker had completed his study of the Flora of New Zealand and was currently engaged in the elaboration of the Flora of Tasmania, a botanical investigation of the alps of continental Australia was highly desirable.

With His Excellency's sanction, Mueller set out on the 1st of November 1854 to explore the alps both inside and outside the colony's border. He travelled down the La Trobe valley then across to the Avon River, where Angus McMillan, an early explorer and settler in Gippsland, had a property, 'Bushy Park'. On the snow-stormy 14th November 1854 he ascended Mt Wellington. Between the summit of Mt Wellington and the nearby Haidinger Range, Mueller collected about 40 species, of which eight were new (Willis 1989). The gem of his collection was a small white buttercup which he discovered on Mt Wellington. In his letter to Hooker from McMillan's property, Mueller (1855a) officially named it *Ranunculus Millani* after his host and described it in Latin. With the publication of this letter in *Hooker's Journal*, Angus McMillan was botanically commemorated for his ascent and naming of Mt Wellington and other peaks, and for his assistance to Mueller. By then Mueller (1855b) had also described *R. Millani* in a paper on Australian alpine plants which he presented to the Philosophical Society of Victoria in September 1855. Two specimens which Mueller collected from Mt Wellington in November 1854 are type specimens for *R. millanii* in the National Herbarium of Victoria.

On the 22nd of November 1854 Mueller left the Avon River intent on climbing the Bogong mountains which he considered to be the heart of Australia's alps and king of Victoria's mountains. Mueller travelled up the Mitchell, Wentworth, and Dargo Rivers, and crossed the Dividing Range near the upper part of the Cobungra River to approach Mt Bogong from the south. He reported that on the 3rd of December he ascended the two highest and still snowclad peaks of the Bogong Range, which, in the mistaken belief that they were Australia's highest peaks, he named after Victoria's first two governors:

> 'Considering that mountains of such altitude, probably the two highest in the Australian Continent, deserve distinctive names, I solicit His Excellency's permission to name the grandest of both Mount Hotham, and the second in height Mount La Trobe, — as I trust to be entitled to the great honor of being the first man who ever reached these commanding summits of the Australian highland' (Mueller 1855c).

Mueller (1855c) also sought to name other peaks and plateaux after respected scientists, surveyors and explorers — Hooker's Plateau, Mount Leichardt [*sic*],

Kennedy's Height, Mitchell's Plateau and Clarke's Peak. Fortunately December 3rd was a clear day and so in order to define the positions of his two peaks, Mueller took compass bearings from their summits on surrounding known peaks

Mueller (1855c) noted that on both mountains:

> 'mighty masses of snow lay far below the summits, lodging chiefly in the ravines, and these never melt entirely under the summer sun.'

and that a:

> 'depressed Glacier Flora, imitating in some degree the botanical features of the European and other Alps, covers scantily the icy tops' (Mueller 1855d).

The two peaks yielded 23 plant species including the type specimens of five (Willis 1989). Mueller (1855d: 5) noted that:

> 'Reflecting on the general results of this journey, I trust to be justified in considering them not without some importance, at least for the geography of plants. The expedition was planned more with a view of ascertaining the alliance between the vegetation of the Alps of Australia and plants of other countries, than with anticipations of largely enriching thereby the number of plants already under notice. Still . . . the total amount of either truly alpine, or at least subalpine plants of this country, exceeds 100 species, and it is pleasant to perceive that half of these are endemic, or not yet elsewhere discovered; whilst by far the greater part of the other half comprises such as inhabit Tasmania, or are likewise natives of New Zealand . . . I beg to allude to the sudden reappearance of several European plants in the heart of the Australian Alps . . . : — Turritis glabra, Sagina procumbens, Alchemilla vulgaris, Veronica serpillifolia, Carex Pyrenaica, Carex echinata, Carex canescens, Carex Buxbaumii, and Botrychium Lunaria.'

On reaching Omeo, excited by his physiographical findings and eager to have his names officially recognized, Mueller dashed off a special report describing his mountain discoveries to the Colonial Secretary in Melbourne. He sent a copy of this report and a more botanical letter to Sir William Hooker and both duly appeared in Hooker's Journal (Mueller 1855e & f).

Mueller continued via Mt Tambo to the Munyang (Snowy) Mountains. On New Year's day he reached the most northerly peak and later ascended Mt Kosciusko. Mueller's specimens for over one third of the 70 species which he collected in the Snowy Mountains are type specimens (Willis 1989). They include *Ranunculus anemoneus* (Fig. 2) which grew along springs near summits of the Snowy Mountains and *Caltha introloba* from gravelly places irrigated with melting snow. En route back to Melbourne Mueller (1855g) informed Hooker briefly with taxonomic indecision of the more interesting plants:

> 'One of the most remarkable amongst them is assuredly a large-flowering *Ranunculus*, with generally numerous and always white petals, having much of the habit of an *Anemone*. It grows very seldom below 6000 feet, and chiefly on springs and on the margin of melting snow. Five Umbelliferae, belonging to as many distinct genera, are associated with it, as also a dwarf inconspicuous Composite, with leaves much like *Oreobolus*, a slender procumbent *Pentachondra*?, a monostachyous *Carex*, a rooting *Gnaphalium*, a very distinct *Plantago*, and a smooth *Craspedia* (*C. leucantha*), with white flowers and sphacelate scales . . .
>
> The Ranunculaceous *Caltha*-like plant with inward bent leaves, to which I previously referred [in letter from Omeo (Mueller 1855f)], is frequent enough on the Munzang [*sic*] Mountains, and after having seen it in a more advanced state I am much more inclined to refer it to *Caltha* . . . I should be delighted, Sir William, in finding, after my return, Dr. Hooker's Flora of New Zealand, and what may be printed of the Flora of Tasmania, arrived by your orders, so that I can draw a comparison in the botanical features of the Australian Highlands.'

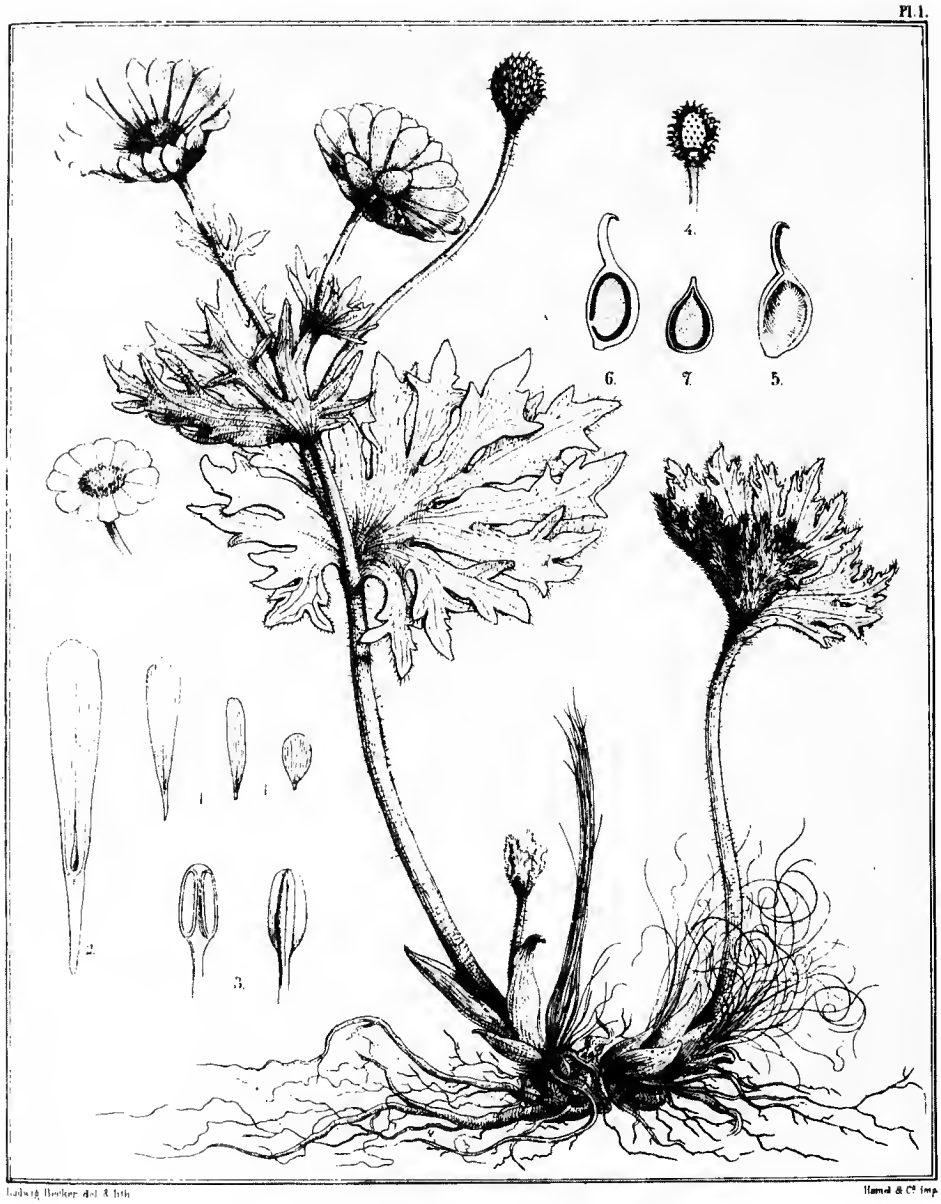


Fig. 2. *Ranunculus anemoneus* reproduced from *The plants indigenous to the Colony of Victoria*, F. Mueller (1864–1865)

Mueller believed that his survey of the flora of the alps was reasonably complete and wrote to Hooker that:

> 'the plants mentioned in this and the two previous letters, together with those noticed in my reports, comprehend almost completely the Alps flora of this continent' (Mueller, 1855g).

Via a circuitous route including the Buchan and Snowy Rivers, Mueller (1855d) returned to Melbourne, regretting that due to illness he was again prevented from ascending Mount Baw Baw:

> 'a wild, rocky, isolated summit at the south-western slope of the Australian Alps, hitherto unexplored, and perhaps the only locality from which additions may be expected of importance to our knowledge of the Alpine Flora.'

A Misidentification of Mountains

Visible elements such as rain, floods and fire had obstructed Mueller on earlier trips. However on his most important alpine trip he was a victim of the unseen. In December 1854, despite his meticulous recording of the visible physiography of the area, Mueller's correct interpretation of his alpine whereabouts was thwarted by an invisible element. This caused him to write himself into Victoria's alpine history on the wrong peaks, and deprived him of the privilege of providing permanent names for those peaks. The problem was that Mueller's compass bearings on known mountains taken from his 'Mt La Trobe' and 'Mt Hotham' could not be reconciled with later surveys, so that the true identity of the peaks climbed and named by Mueller remained a mystery for many decades. Thus was history converted into mystery.

Mueller deeply regretted that those peaks received the names given subsequently by others and he continued to smart at the injustice of it. He was disappointed that Skene's 1874 map of Victoria included no recognition of his discovery of Mt Hotham or his later-named Barkly Range (Mueller to Shillinglaw, no date). A decade later, when James Stirling sent Mueller a copy of his geological map of the alps, Mueller replied that:

> 'What is called now Mt. Feathertop is my Mt. Hotham of 1854, and what is named Mt. Bogong I called then already Mt. Latrobe. (Barnard 1904: 24).

Despite Mueller's admission that his 'Mt Hotham' was not the officially-named Mt Hotham, the myth of Mueller's 1854 ascent of Mt Hotham endured for many decades.

Nearly a century after Mueller's trip another botanist, Norman Wakefield offered a geological explanation. Wakefield (1950) argued that consistent compass errors due to magnetic interference from basalt rocks were responsible for the mystery. By correcting Mueller's compass readings, his 'Mt Hotham' could indeed be identified as Mt Feathertop, but his 'Mt La Trobe' appeared to be Mt Loch rather than Mt Bogong.

A decade later another botanist went further. Stella Maisie Carr, who had carried out extensive ecological studies on the Bogong High Plains, used botanical, magnetic, and historical clues to attempt to reconstruct Mueller's route from his very brief report. Carr (1962) suggested that Mueller travelled up the valley of the Dargo River to its headwaters, crossed the Divide near the upper part of the Cobungra River, and rode across the grassy tablelands at its headwaters then on to Mt Loch (Mueller's 'Mt La Trobe'). From there Machinery Spur would appear an obvious route to the foot of Mt Feathertop (Mueller's 'Mt Hotham'). Although Mueller did not mention the two stockmen at George Gray's Cobungra run, Carr (1962) believed that he probably followed the Cobungra River downstream until he found their track to Omeo.

Thus it was that plants, whose only habitats are near Mt Bogong, were never discovered by Mueller, who did not realize that Victoria's highest alpine flora had eluded him. On the labels of his herbarium specimens and in his published descriptions of the plants he collected from Victoria's alps in December 1854, Mueller (1855b) used his geographical names for the collecting localities of those plants. A knowledge of history as well as geography is obviously vital for the correct interpretation of these botanical labels and papers!

Mueller would be pleased that, a century after he had suggested it, one of his geographical names did reappear. In honour of Sir William Hooker, Mueller had given the name 'Hooker's Plateau' to a region which Wakefield (1950) calculated would be close to the summit of Mt Bogong. After Wakefield's article was pub-

lished, the name 'Hooker Plateau' appeared near Mt Bogong on SEC, Department of Lands and Survey, and Army maps (Anon 1969). It appears on the Bogong Sheet of Keith McDougall's recent Vegetation Map of the Bogong High Plains, just SWW of Mt Bogong.

Beyond Wellington

In 1855 and 1856 Mueller accompanied Gregory on his northern Australian expedition. Two years after his return, Mueller visited Victoria's high country for the fourth time. He was accompanied by Angus McMillan, who supplied six horses and other requisites (Mueller to O'Shanassy, Jan. 1859). His short trip in January 1859 included an examination of the vegetation around the sources of the Macalister river, but was of greater geographical than botanical interest. Few plant specimens were collected, with very few representing new species. Mueller (1860: 9) charted numerous geographical features, including a great range which he named in honour of the Governor, Sir Henry Barkly.

> 'In this journey, the main range of the South Western Alps was ascertained to extend in an almost semi-eliptical line from Mount Wellington to Mount Useful, at an elevation varying from 4000 to 5000 feet, only the northern part of this mountain tract, encircling the sources of the McAllister [*sic*], being more depressed and somewhat broken. From several high mountains, then ascended for the first time, bearings were secured to elevations included in the trigonometrical survey. From the more elevated western portion of these mountains, now designated on the chart as the Barkly Ranges, a leading spur will in all probability be found to the hitherto unapproached alpine elevations of Mount Baw Baw.
>
> This question which I left during my first visit unsolved I am anxious to set at rest during the next season. Mount Wellington, inasmuch as it can be reached by a path accessible to horses from the Avon Ranges, may be regarded as the southern key of the Australian Alps, from whence along the crest of the main ramifications of the high land a journey with horses seems possible in most directions. Otherwise, the dense underwood of the less lofty ranges, stretching between the alpine tract and the low land, frustrates any attempt to traverse the country between the Yarra sources and Gipps Land without cutting previously tracts through the jungle, whereas the main range, at elevations exceeding 4000 feet, is usually destitute of these impediments.' (Mueller 1860: 9)

The Baw Baws

By the end of the 1850s, Mueller had still not visited the south-western end of Victoria's alps. His phytological ignorance of this area, caused Mueller (1858a: 8) to delay production of the first fascicle of his proposed 'Flora of Victoria'. In 1860, while President of the Royal Society of Victoria, as well as a very busy Government Botanist and Director of Melbourne's Botanic and Zoological Gardens, Mueller did manage to find time to visit this part of the alps. In December 1860 he made his first ascent of the previously unexplored Baw Baws, a peak of which now bears his name.

Mueller (1861a: 13) approached the Baw Baws from the south — from Good Luck Creek where gold had recently been discovered by E.W. Gladman. He could not take his horses. The ranges were so broken and scrubby that to walk through the bush he had to cut a track as he went. He even offered two lone prospectors one shilling each per day to go with him to the summit. They declined. He consulted Mr Gladman who, during his difficult prospecting journey, had mapped part of the country between the Baw Baw Mountains and the La Trobe River. On the 23rd of December, accompanied by five men from the diggings, Mueller set out from Good Hope Creek.

Mueller (1861a: 13) reported that:

> 'In our progress over the ranges, which are chiefly timbered with Stringybark trees and a species of White Gum tree, we encountered much impediment by the density of the scrub, the tough-branched Corraea ferruginea being particularly obstructive to our march, until in gradual advance to the higher regions the underwood of the lower mountains recedes before the colder temperature, it being universally observed in our Alps, that at elevations above 4000 feet the dense scrubs chiefly on the sea-side slopes of our ranges either vanish or greatly diminish.
>
> After having descended into the main valley of the Upper Tangil [now Tanjil], a beautiful mountain torrent, which rolls its waters with impetuosity over the granite boulders of its bed, a total change in the physiognomy of the vegetation was observed; whilst ascending the main range of Mount Baw Baw, the Stringybark trees were found replaced by delightful Beech forests which surround the main mountains on all sides, and are interspersed with Highland White Gum trees (Eucalyptus coriacea) and Cider trees (Eucalyptus Gunnii), under the shade of which certain ferns (Aspidium proliferum and Lomaria procera) predominate. Nothing can surpass the contrast in the landscape when we emerge from the dreary scrub to the shady forest of these evergreen Beeches (Fagus Cunninghami) which in a dwarfish form ascend even to the alpine summits of this range.'

Mueller may not have been far enough north for the upper Tanjil. In this unexplored and un-mapped wilderness it is not surprising that there should be some confusion about the names of streams.

On Christmas Day 1860 they camped on the summit of the highest eastern mountain of the Baw Baws. On the Baw Baws they observed koalas and wombats but no wild cattle, which were then found in many other parts of the alps. They traversed the length of the Baw Baw mountains and beyond to what Mueller (1861a: 14) believed to be the undiscovered eastern sources of the Yarra River — 'in alpine plains, elevated 4000–4500 feet, scrubby with heath-like vegetation and a variety of highland bushes, and producing occasional patches of grass and sphagnum-moor'. He considered this a suitable place for the liberation of red and fallow deer and scattered seeds of the large fruited Canada blackberry near alpine springs (Mueller 1871: 109). Returning via their track cut through the 'jungle', they reached Good Hope Creek on December 30.

During his week on the Baw Baws Mueller collected over 60 species. However, because the flora was similar to other alpine areas which he had already visited, only six were new species (Willis 1989). One was an attractive plant from the 'sources of the Yarra' and the 'Upper Tyers', which he collected for the Botanic Gardens. Mueller (1861b: 136) named this unusual heath plant *Wittsteinia vacciniacea* (Fig. 3) after the renowned German phytochemist, Dr G.C. Wittstein. Four of Mueller's specimens are now the type specimens for *Wittsteinia vacciniacea*. Since Mueller placed it with *Gaultheria* in the Ericaceae, *Wittsteinia vacciniacea* has kept its name but not its taxonomic position. The Baw Baw berry has been in and out of the Epacridaceae and is now the sole Victorian member of the Alseuosmiaceae. Following his discovery Mueller (1861a: 15) reported that:

> 'The restriction of this plant to the south-western part of the Alps, where it occurs in millions, as also the extensive existence of Libertia Lawrencii, Oxalis Magellanica, and the vast prevalence of Fagus, are to be ascribed to the increased humidity of the climate in this part of the snowy mountains, caused by the copius fern-tree vegetation of the surrounding country south and westward. To the same cause the timber, although in a diminutive state, owes its existence on the summit of these mountains at elevations which in other parts of the Alps are denuded of forest. Yet, although the above-mentioned plants introduce still more strikingly the

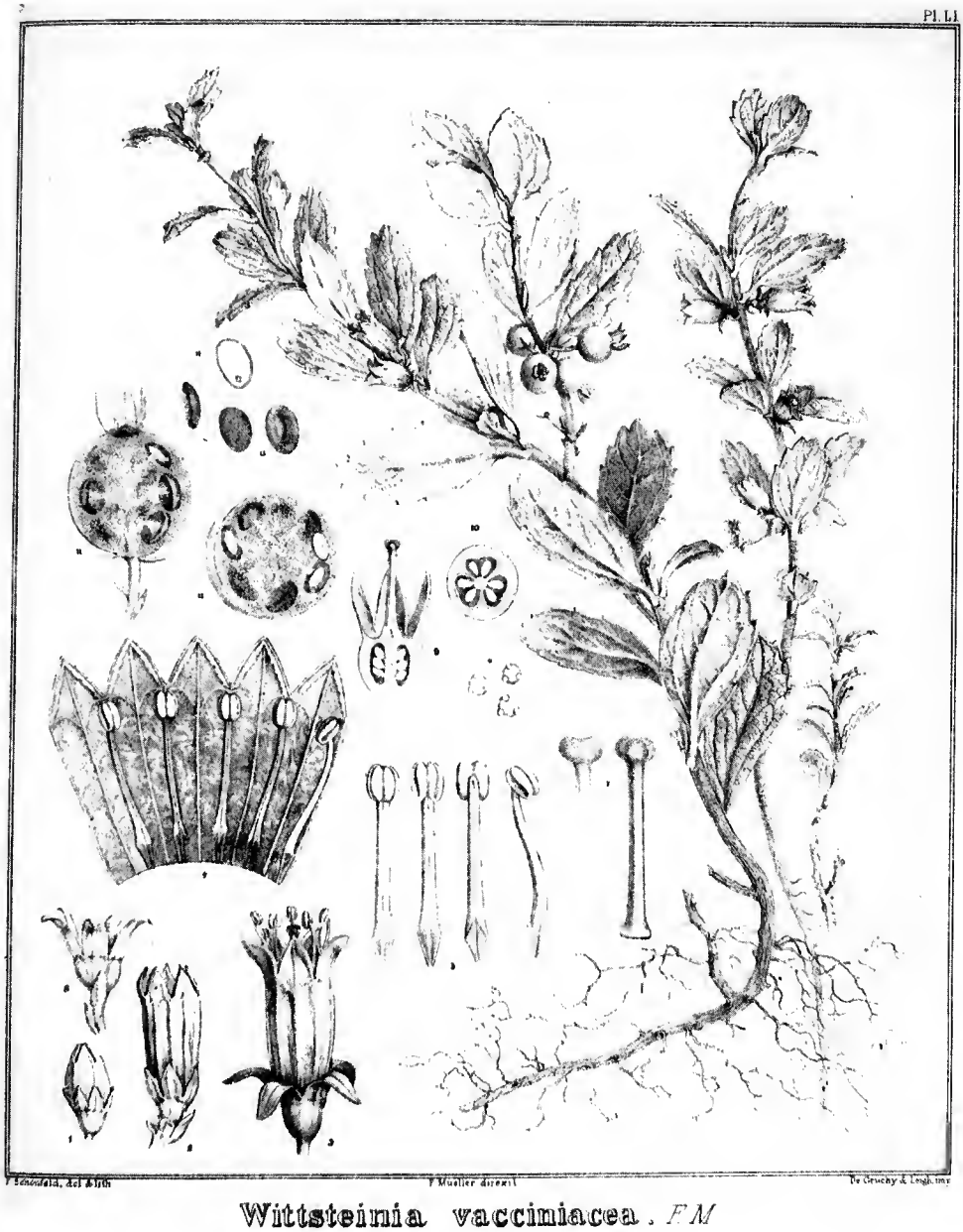


Fig. 3. *Wittsteinia vacciniacea* reproduced from *The plants indigenous to the Colony of Victoria*, F. Mueller (1864–1865)

feature of the highland vegetation of Tasmania into our Alps, my expectations of seeing amongst many other Tasmanian mountain plants also some of the curious alpine pines of that island reappear in our highlands, was not verified ... Decaspora Clarkei (a dwarf half-shrub, with exquisite edible berries), Leucopogon Maccraei, Orites lancifolia, Prostanthera cuneata, Podocarpus alpina, Gualtheria [*sic*] hispida, and especially dwarf scrubs of Tasmania aromatica were very conspicuous on

> the Baw Baw ranges, whilst Lycopodium scariosum, Mitrasacme montana, Oxalis Magellanica, and Uncinia compacta were only on this occasion ascertained to exist in the Australian mainland.'

After his Baw Baw trip Mueller (1861a: 15) confirmed his earlier suggestion that the whole of the Australian Alps could be traversed with pack-horses along the ridges, where there were adequate springs and pastures.

Around Wellington

In March 1861 Mueller set off once more from 'Bushy Park' on the Avon River. With Angus McMillan again providing horses and requisites, Mueller (1862: 8) made a brief visit up the valley of the Macalister River to its rugged mountain sources and discovered a 'beautiful and fertile alpine table land' and a gentle descent from it into the valley and thence to the plains of Gippsland.

Two years later Mueller (1863: 9) was again in the mountains:

> 'The botanical investigations of the territory of our colony, now nearly completed, has during the last summer been extended from the Bunyip River to the sources of the Tarwan [*sic*], Tyers and La Trobe Rivers, and thence along the Upper Yarra Ranges to the sources of the Thomson River and Mount Useful.'

Accompanied by Alfred Walker and George Johnson, Mueller also traversed the ranges which he had attempted to name the Barkly Ranges. In the expectation that 'many of the gullies over which I passed will prove auriferous', Mueller (1863: 9) recommended that tracks be cut along the main ranges 'for the purpose of enabling the miners to advance with pack-horses to those positions from which the valleys can be readily explored.' Mueller recommended McMillan for the job (Mueller to Public Works, 1863). Both recommendations were later implemented by the Government.

At the end of his first decade as Government Botanist, Mueller had good reason for some satisfaction. He had completed a comprehensive botanical perlustration of the full extent of Victoria's alps — from the Baw Baws to the Cobberas and had discovered and named many floral and physiographical features. Unfortunaely his success at plant naming was not matched by that of his mountain naming, which caused him some dissatisfaction. In subsequent years he did visit the alps (Mueller to Jephcott, 5 Sept. 1877) but never as part of an epic field trip like those of the 1850s.

AAAS Excursion — Hotham at Last

Mueller's last glimpse of his beloved alps was when he was 64 years old. As president of the young Australasian Association for the Advancement of Science (AAAS) Baron von Mueller participated in the AAAS's alpine excursion to Mt Hotham (Fig 4) in January 1890. Mueller, ever practical, brought violet and strawberry runners to plant along the Diamantina creek just below the summit (Anon 1890). Although the myth of Mueller's 1854 ascent and naming of Mt Hotham persisted even after his AAAS visit, this was not the Mt Hotham climbed and named by him a generation earlier. In 1890 'The Baron' (Figs 5 & 6) was treading this part of Victoria's alps for the very first time.

In Retrospect

Mueller was undoubtably the first biological scientist to investigate Victorian's alps in a professional capacity. Due to his extensive alpine explorations Victoria's high mountain flora was reasonably well documented very early in the colony's history — within the first decade of its separation from NSW. Having climbed almost every major range, from Kosciusko in the north-east to the Baw Baws in the south-west, and brought back to Melbourne's National Herbarium a wealth of specimens, Mueller is the great botanical pioneer not only of Victoria's but of Australia's alps. In the seven volumes of Bentham's Flora Australiensis

Fig. 4. *The camp at Mt Hotham* reproduced from the *Illustrated Australian News and Musical Times* 1 Feb. 1890. (Reproduced by permission of the La Trobe Collection, State Library of Victoria)

(1863–78), over 200 species from the alps were cited as collected by Mueller, one third of them previously undescribed (Willis 1989).

Compilation of the flora of Victoria's alps did not stop with the cessation of Mueller's epic alpine explorations but it did slow down, depending on specimens sent to Mueller by other visitors to the alps. Decades would elapse before anyone else would make significant collections in the region.

Fig. 5. *The Baron Discourses* reproduced from the *Illustrated Australian News and Musical Times* 1 Feb. 1890. (Reproduced by permission of the La Trobe Collection, State Library of Victoria)

Fig. 6. *Botany* reproduced from the *Illustrated Australian News and Musical Times* 1 Feb. 1890. (Reproduced by permission of the La Trobe Collection, State Library of Victoria)

ACKNOWLEDGEMENTS

I wish to thank Sara Maroske, Helen Cohn and Doris Sinkora at the National Herbarium of Victoria for vital information and comments. The La Trobe Collection, State Library of Victoria granted permission to reproduce Figures 4, 5 and 6.

REFERENCES

Unpublished Letters

Transcripts of Mueller's letters were kindly supplied by Sara Maroske of the Mueller Correspondence Project.

Mueller to Lonsdale, 29 Jan. 1853. B53/1036, unit 408, VPRS 3991 inwards registered correspondence, VA 860 Chief Secretary's Office, Public Record Office, Laverton, Victoria, Australia.

Mueller to Hooker, 3 Feb. 1853. Royal Botanic Gardens, Kew. Correspondence vol. 74: Australian letters 1851–58.

Mueller to Lonsdale, 9 March 1853. A53/2892, unit 408, VPRS 3991 inwards registered correspondence, VA 860 Chief Secretary's Office, Public Record Office, Laverton, Victoria, Australia.

Mueller to Foster, 22 Aug. 1853. D53/8374, unit 203, VPRS 1189 inwards registered correspondence, VA 856 Colonial Secretary's Office, Public Record Office, Laverton, Victoria, Australia.

Hooker to Mueller, 9 Apr. 1854. Royal Botanic Gardens & National Herbarium Archives, M2.

Mueller to Foster, 18 Apr. 1854. E54/4192, unit 203, VPRS 1189 inwards registered correspondence, VA 856 Colonial Secretary's Office, Public Record Office, Laverton, Victoria, Australia.

Mueller to Foster, 9 Oct. 1854. G54/11156, unit 203, VPRS 1189 inwards registered correspondence, VA 856 Colonial Secretary's Office, Public Record Office, Laverton, Victoria, Australia.

Mueller to O'Shanassy, no date [Jan. 1859]. K59/188, unit 747, VPRS 1189 inwards registered correspondence, VA 860 Chief Secretary's Office, Public Record Office, Laverton, Victoria, Australia.

Mueller to Public Works, no date [1863], VPRS 1114, unit 1 p381. Abstract of letter.

Mueller to Shillinglaw, nd [soon after October 1875]. Box 244/1, Shillinglaw papers, La Trobe Collection, State Library of Victoria, Melbourne, Victoria, Australia.

Published Sources

Anon (1890) Alpine Notes. *The Sun* 31 January 1890, p. 11.

Anon (1969) Appendix to Wakefield's 1950 article reprinted in The Gap (an educational and historical magazine produced in the Bairnsdale Inspectorate) 7: 56.

Barnard, F.G.A. (1904) Some Early Botanical Explorations in Victoria. *Victorian Naturalist* 21: 17–28.

Bentham, G. (1863–78) *Flora Australiensis*. (Lovell Reeve & Co.: London.)

Carr, Stella G. M. (1962) The Discovery of the Bogong High Plains. *Proceedings of the Royal Society of Victoria*. 75: 285–289.

Cohn, Helen M. (1989) Ferdinand Mueller, Government Botanist: The Role of William Hooker in his Appointment. *Muelleria* 7(1): 99–102.

Daley, C. 'Baron Sir Ferdinand von Mueller, K.C.M.G., M.D., F.R.S, Botanist, Explorer, and Geographer' reprinted from the *Victorian Historical Magazine* 10 (1924) May and December.

Hart, T. S. (1950) Compass observations affected by magnetic rocks. *Victorian Naturalist* 66: 199.

Maroske, Sara & Helen Cohn (1992) 'Such ingenious Birds': Ferdinand Mueller and William Swainson in Victoria. *Muelleria* 7(4): 000–000.

Mueller, F.(1853) First General Report of the Government Botanist on the Vegetation of the Colony, 5 September 1853, *Votes and Proceedings of the Legislative Council of Victoria, 1853–4*, vol 1, Paper no A.26a.

This report was also published in *Hooker's Journal of Botany and Kew Garden Miscellany* 6: 123–126, 151–156 (1854).

Mueller, F. (1854a) Botany of Victoria Colony. *Hooker's Journal of Botany and Kew Garden Miscellany* 6: 156–158.

Mueller, F. (1854b) Second General Report of the Government Botanist on the Vegetation of the Colony, 5 October 1854, *Votes and Proceedings of the Legislative Council of Victoria, 1854–5*, vol 1, Paper no A.18.

This report was also published in *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 306–314 (1855).

Mueller, F. (1855a) Botany of Victoria (Southern Australia) *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 357–360.

Mueller, F. (1855b) Descriptive characters of new alpine plants. *Transactions of the Philosophical Society of Victoria* 1: 96–111.

Mueller, F. (1855c) Report of Government Botanist's Journey to Omeo, 16 December 1854, *Votes and Proceedings of the Legislative Council of Victoria, 1854–5*, vol 2, pt 1, p 233, Paper A45

This paper was also published in Mueller (1855e).

Mueller, F. (1855d) Annual Report from the Government Botanist for the year 1854, 25 June 1855, *Votes and Proceedings of the Legislative Council of Victoria, 1855–6* vol. 1, Paper no. A10.

Mueller, F. (1855e) The Government Botanist's Report of his Journey from Melbourne to Omeo in the Australian Alps. *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 179–181.

Mueller, F. (1855f) Botany of Victoria (Southern Australia) *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 233–235.

Mueller, F. (1855g) Botany of Victoria (Southern Australia) *Hooker's Journal of Botany and Kew Garden Miscellany* 7: 235–237.

Mueller, F. (1858a) Annual Report of the Government Botanist and Director of the Botanic Garden, 24 October 1858, *Votes and Proceedings of the Legislative Assembly 1858–9* vol. 2, Paper no. 17.

Mueller, F. (1858b) *Fragmenta Phytographiae Australiae.* vol. 1. Melbourne.
Mueller, F. (1860) Annual Report of the Government Botanist and Director of the Botanical and Zoological Garden, 12 January 1860, *Votes and Proceedings of the Legislative Assembly 1859–60*, vol 4, Paper No 37.
Mueller, F. (1861a) Annual Report of the Government Botanist and Director of the Botanic and Zoologic Garden, 10 January 1861, *Votes and Proceedings of the Legislative Assembly 1860–1*, vol 3, Paper no 19.
Mueller, F. (1861b) *Fragmenta Phytographiae Australiae* vol. 2.
Mueller, F. (1862) Annual Report of the Government Botanist and Director of the Botanic Garden, 10 March 1862, *Votes and Proceedings of the Legislative Assembly 1861–2*, vol 3, Paper no 105b.
Mueller, F. (1863) Annual Report of the Government Botanist and Director of the Botanic Garden, 15 April 1863, *Votes and Proceedings of the Legislative Assembly 1862–3*, vol 4, Paper no 61.
Mueller, F. (1871) Forest Culture in its relations to Industrial Pursuits: A lecture delivered 22 June 1871. *In* Cooper, E. (ed.), *Forest Culture and Eucalyptus Trees,* (Cubery & Company, Steam Book and Ornamental Job Printers: San Francisco.) pp. 45–120.
Wakefield, N.A. (1950) Baron von Mueller's Victorian Alps *Victorian Naturalist* 66: 169–76.
Wakefield, N.A. (1969) Botanical Exploration of East Gippsland. *Proceedings of the Royal Society* 82: 61–67.
Willis, J.H. (1989) Baron von Mueller's Travels in the Australian Alps, 1853–61. *In* Good, R. (ed.), *The Scientific Significance of the Australian Alps. The Proceedings of the First Fenner Conference on the Environment,* (The Australian Alps National Parks Liaison Committee: Canberra.) pp. 381–382.

Manuscript revised 12 September 1991

PTILOTUS ERIOTRICHUS (AMARANTHACEAE) REVISITED

by

P.S. SHORT*

ABSTRACT

Short, P.S. *Ptilotus eriotrichus* (Amaranthaceae) revisited. *Muelleria* 7(4): 491–494 (1992). — The types of the names *Ptilotus eriotrichus* W. Fitzg. and *Trichinium eriotrichum* W. Fitzg. ex Ewart & White have been examined and the names found to be taxonomic synonyms. The combination *Ptilotus eriotrichus* (W. Fitzg. ex Ewart & J. White) P. Short is an illegitimate later homonym of *Ptilotus eriotrichus* W. Fitzg., the correct name for the species under discussion.

INTRODUCTION

Recently I (Short 1991) published a new combination, *Ptilotus eriotrichus*, based on *Trichinium eriotrichum* W. Fitzg. ex Ewart & White (1910). However, the validly published name *Ptilotus eriotrichus* W. Fitzg. (1912), which is generally believed to apply to the same species, precludes my combination and therefore renders it illegitimate or, if based on the same type, redundant, because the combination already exists.

The types of *Ptilotus eriotrichus* W. Fitzg. and *Trichinium eriotrichum* W. Fitzg. ex Ewart & White, are quoted in the protologues as 'Cowcowing; Max Koch (no. 1217)' and 'Cowcowing, *Max Koch*, 1904' respectively. To ascertain whether the two names definitely refer to the same species or whether a new name is needed for *Trichinium eriotrichum* when transferred to *Ptilotus*, I examined pertinent publications, correspondence and herbarium specimens which may qualify as types of the two names and checked their identity and handwriting on the specimen labels against letters of known autography.

PUBLICATIONS

Trichinium eriotrichum W. Fitzg. ex Ewart & White and *Ptilotus eriotrichus* W. Fitzg. were independently and validly published. The later *Ptilotus eriotrichus* W. Fitzg. is clearly not based on the earlier *Trichinium eriotrichum* W. Fitzg. ex Ewart & White as would appear from the erroneous author citation '(W. Fitzg. ex Ewart & White) W. Fitzg.' used by some writers (e.g. Benl 1971; Green 1981, 1985) for *Ptilotus eriotrichus*. As previously noted (Short 1991) this is evident from several sources, i.e. Fitzgerald's lack of reference to their work in his publication, the note, presumably by James Britten (Anon. Sept. 1912) that Fitzgerald's paper had been in the possession some time before its publication, and the claim by Ewart (Dec. 1912) that he had unsuccessfully attempted to contact Fitzgerald about the publication of his manuscript names.

UNPUBLISHED CORRESPONDENCE

Letters to Koch from Fitzgerald and Ewart, between Fitzgerald and Ewart, and from Ewart to Maiden (Ewart 1907–1909; Fitzgerald 1907–1908) were examined to try to ascertain just when, and where from, the authors of both names acquired specimens. The letters from Fitzgerald to Koch indicate that Fitzgerald saw collections of various species gathered by Koch in both MEL and NSW, and that initially Ewart sent collections gathered by Koch to him for study. At no stage

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria Australia 3141.

do Fitzgerald's letters to either Koch or Ewart specifically refer to *Ptilotus eriotrichum* or *Trichinium eriotrichum* or the specimen *Koch 1217*. However, in a letter dated 6 August 1907 and sent to Koch, Fitzgerald does mention various collections gathered by Koch in 1904 and 1905 that had been brought to his attention by Maiden when visiting NSW. Amongst these were specimens of *Acacia ewartiana*, a species described in the same paper as *P. eriotrichus*. This suggests that Fitzgerald first saw material of *Koch 1217* when in NSW.

Correspondence suggests that Ewart first saw material of *Koch 1217* when it was sent from NSW. In a letter dated 10 July 1907 and sent to Fitzgerald, Ewart stated that 'Regarding Koch's specimens, I should be glad if you would send me a portion of each labelled in your handwriting, especially of the new species'. Ewart subsequently recorded in a letter to Maiden dated 10 March 1909 that:

> 'Under date July 19th 07 I received from you some West Australian specimens collected by Max Koch with M.S. names by W. V. Fitzgerald. I find on examination that No. 1522 Petrophila . . .
> We have specimens (Koch's) marked by Fitzgerald with new names as W.V.F. inedit. on Herb. Sydney labels (Angianthus axiliflorus W.V.F. inedit. etc.) Do you know whether and where Fitzgerald has published these?'

It would seem that the aforementioned parcel did include a specimen of *Koch 1217*. A letter from Ewart to Koch dated 20 May 1909 reads:

> '1217 Labelled Ptilotus eriotrichus W. V. Fitzg. It does not agree exactly with any of our types. Has the name been published? If so! Where? Can you spare any more material of 1217, 1662 & 1616?'

He was to repeat his request to Koch for 'more material of No. 1217 Ptilotus eriotrichus, W. V. Fitzgerald M.S.' in a letter dated 16 August 1909.

Thus the available correspondence suggests that it is quite possible that Ewart and White's description of *Trichinium eriotrichum* was based on a specimen that had been viewed by Fitzgerald and which would also be a syntype of the name *Ptilotus eriotrichus*. It also suggests that with the movement of specimens there is a possibility that *P. eriotrichus* W. Fitzg. could have been based on syntype material of *T. eriotrichum* Ewart & White that was returned to NSW.

COLLECTIONS OF KOCH 1217

In the search for the types of the two names, the following sheets, all annotated as *Koch 1217* and labelled as coming from Cowcowing, have been examined:

NSW 238289: this specimen is accompanied by a printed 'W. V. Fitzgerald' herbarium label that has in Fitzgerald's hand the information 'Ptilotus eriotrichus W.V.F./ Type/ Coll. Max Koch/ Cowcowing/ September 1904". At some stage the spelling of the specific epithet has been altered to 'eriostrichus", as appeared in Fitzgerald's publication. Koch's original label is also attached and reads 'Amarantaceae/ 1217/ Ptilotus/ Loc. Cowcowing WA/ Coll. Max Koch. x.1904'. Note the conflicting information on the respective labels as regards collecting times, i.e. October as opposed to September. There is no annotation suggesting that the specimen was examined by Ewart and White.

NSW 238290: the original collector's label has 'Ptilotus eriotrichus W. V. Fitzg. n. sp.' in Koch's hand and the date of collection is recorded as 'iix.1904', i.e. August. It has not been annotated by Fitzgerald or by Ewart and White.

NSW 30522: the original collector's label has 'Ptilotus eriotrichus W. V. Fitzg. n. sp.' in Koch's hand and the date of collection is recorded as 'ix.1904', i.e. September. It has not been annotated by Fitzgerald., nor I think by Ewart and White. There is a further handwritten label with the Ewart and White name which gives the place of publication but as far as I can ascertain it is in neither of their hands.

PERTH: the sheet has three labels and reference to both Fitzgerald's name and Ewart & White's name are made but are in Koch's hand. The specimen was gathered in August 1904.

MEL 1579234: this sheet contains the larger of the specimens of this species at MEL. The original label in Koch's hand, records '1217/ Ptilotus eriotrichus/ W. V. Fitzgerald/ n. sp./ Cowcowing/ ix. 1904'. Superimposed upon this label some one, I suspect White, has indicated that the collection is the 'type' of *Trichinium eriotrichum*. Also attached to this sheet are original notes pertaining to the illustration published by Ewart and White.

MEL 1579236: has no original labels, but has a note by a former MEL staff member that it is a 'fragment of the holo-type' of *T. eriotrichum*.

The three sheets of *Koch 1217* in NSW have been entered on the computerised NSW database with the note on two of them that 'this collection comprises 3 sheet(s), NSW nos.: 238289, 238290 & 30522'. However, they cannot be regarded as a single collection. As should be quite evident Koch used species numbers, not separate numbers, for each collection and this species was collected on three separate occasions, i.e. August, September and October 1904.

CONCLUSIONS AND TYPIFICATION

Examination of possible type material and comparison with the protologues of the two names *Trichinium eriotrichum* Ewart & J. White and *Ptilotus èriotrichus* W. Fitzg. has shown that they were based on different, but possibly duplicate, specimens of *Koch 1217*, and that there can be no doubt that the two names refer to the one species, i.e. that they are taxonomic synonyms. Therefore, there is no need for another name to accommodate *Trichinium eriotrichum* when referred to *Ptilotus*. The name *Ptilotus eriotrichus* W. Fitzg. is the correct name for this species when it is referred to *Ptilotus*.

Probable Holotype of *Ptilotus eriotrichus* W. Fitzg.

Although the correspondence suggests that Fitzgerald may have seen more than one specimen of *Koch 1217* this is not evident from specimen annotations. The only specimen annotated by Fitzgerald is NSW 238289. In the absence of firm evidence that he examined additional material I have not designated the latter specimen as the lectotype but regard it as a probable holotype. Specimens in MEL and NSW (listed below) that were gathered in Sept 1904 but not annotated by Fitzgerald are possible isotypes.

Probable Holotype of *Trichinium eriotrichum* Ewart & J. White

When describing *Trichinium eriotrichum* Ewart & White definitely had in their possession the material that is today distributed on two sheets, MEL 1579234 and MEL 1579236. No other material annotated by them has been located. It could be argued that additional specimens may have been examined by the authors and that it is more appropriate to select a lectotype. However, in the absence of concrete evidence that this occurred I believe that it is equally appropriate to regard MEL 1579234 as the probable holotype specimen of the name *Trichinium eriotrichum* Ewart & White and the fragmentary specimen MEL 1579236 as an isotype, as is NSW 30522, and possibly also NSW 238289.

Ptilotus eriotrichus W. Fitzg., *J. Bot.* 50: 22 (Jan. 1912) ('*eriostrichus*'). T: 'Cowcowing; *Max Koch* (no. 1217).' Probable Holotype: Cowcowing, ?Oct. or Sept. 1904, *Koch 1217* (NSW 238289), annotated by Fitzgerald. Possible Isotypes: MEL 1579234, MEL 1579236, NSW 30522 (all gathered Sept. 1904, not annotated by Fitzgerald).

Trichinium eriotrichum W. Fitzg. ex Ewart & J. White, Proc. Roy. Soc. Victoria 22(2): 325 (April 1910). — *Ptilotus eriotrichus* (W. Fitzg. ex Ewart & J.

White) P. Short, Muelleria 7: 370 (1991), *nom. illeg.*, *non P. eriotrichus* W. Fitzg. T: 'Cowcowing, Max Koch, 1904.' PROBABLE HOLOTYPE: Cowcowing, Sept. 1904, Koch 1217 (MEL 1579234), annotated apparently by J. White. ISOTYPE: MEL 1579236 (fragment removed from holotype), NSW 30522 (not annotated by Ewart or White, dated Sept. 1904). POSSIBLE ISOTYPE: NSW 238289 (not annotated by Ewart or White, collected ?Oct. or Sept. 1904).

THE SPELLING OF THE EPITHET IN THE NAME *Ptilotus eriotrichus* W. Fitzg.

In Fitzgerald's publication of *P. eriotrichus* (Jan. 1912) the spelling of the epithet was given as '*eriostrichus*'. The correct spelling of this compound word is undoubtedly '*eriotrichus*', to which it was subsequently corrected, presumably by the editor, in an 'Errata' (*J. Bot.* 50: 393, Dec. 1912). The late alteration to the spelling on the label of the probable holotype specimen of this name suggests that Fitzgerald meant to spell the epithet as '*eriotrichus*'. Following Art. 73 it is permissible to correct typographic and orthographic errors that occur in the original spelling of the epithet. Not surprisingly, and as far as I am aware, the spelling '*eriotrichus*' has been adopted in all works that have appeared subsequent to Fitzgerald's original publication (e.g. Benl 1971; Green 1981, 1985) and is used here.

ACKNOWLEDGEMENTS

Bill Barker and Paul Wilson kindly pointed out my initial error, Kevin Kenneally provided copies of Fitzgerald's letters for examination. Jim Ross, and particularly Hansjoerg Eichler, made valuable comments on the manuscript.

REFERENCES

Anon. (Sept. 1912). New West Australian plants. *J. Bot.* 50: 286. [Presumably by James Britten, then editor of the journal.]

Benl, G. (1971). Ein bestimmungsschlüssel für die gattung *Ptilotus* R. Br. (Amaranthaceae). *Mitt. Bot. Staatssamml. München* 9: 135–176.

Ewart, A. J. & White, J. (1910). Contributions to the Flora of Australia, No. 13. *Proc. Roy. Soc. Victoria* 22(2): 315–329, pl. 56–60.

Ewart, A. J. (1907–1909). Letters held in MEL library, (ef)580.774 ROY.

Ewart, A. J. (Dec. 1912). New West Australian plants. *J. Bot.* 50: 375–376. [A letter in response to the criticism published in an earlier part of the journal (p. 286).]

Fitzgerald, W. V. (1907–1908). Six letters sent to Koch. Originals in PERTH.

Fitzgerald, W. V. (1912). New West Australian plants. *J. Bot.* 50: 18–23.

Green, J. W. (1981). Census of the vascular plants of Western Australia. (1st ed.) (Western Australian Herbarium, Dept of Agriculture, South Perth.)

Green, J. W. (1985). Census of the vascular plants of Western Australia. (2nd ed.) (Western Australian Herbarium, Dept of Agriculture, South Perth.)

Short, P. S. (1991). A new combination in *Ptilotus* R. Br. (Amaranthaceae). *Muelleria* 7(3): 369–370.

ADDENDUM

Since this manuscript was submitted a further specimen of *Koch 1217* that is also annotated as 'type' by Fitzgerald has been located in BM. Fitzgerald sent it along with his original manuscript to James Britten (unpublished letter in BM dated 1 Jan. 1912) and it is clearly another syntype specimen of the name *P. eriotrichus* W. Fitzg. It was gathered in August, not September, 1904. Therefore the collection NSW 238289 cannot be regarded as the probable holotype of the latter name but one of two definite syntype specimens. There are also specimens of *Koch 1217* in BM and K that were gathered in Sept. 1904. They are both annotated as *Ptilotus eriotrichus* W.V. Fitzg. by Koch. There is no evidence that they were seen by either Ewart and White or by Fitzgerald.

Manuscript received 10 May 1991; revised 21 June 1991.

LECTOTYPIFICATION OF *FUMARIA MURALIS* Sond. ex Koch (FUMARIACEAE)

by

N.G. WALSH*

ABSTRACT

Walsh, N.G. Lectotypification of *Fumaria muralis* Sond. ex Koch (Fumariaceae). *Muelleria* 7(4): 495–496 (1992). — A specimen at MEL is here selected as the lectotype of *Fumaria muralis* Sond. ex Koch, in lieu of specimens at B which have hitherto been erroneously or dubiously referred to as types.

INTRODUCTION

While preparing an account of the Fumariaceae for the *Flora of Australia*, it was necessary to consult type material of *Fumaria muralis* Sond. ex Koch, *Syn. Fl. Germ.* ed. 2, 1017 (1845). Koch cited as type material specimen(s) collected by Sonder near Hamburg ('In muris prope Hamburgam'). M. Liden (1986) indicated that the type specimen of *Fumaria muralis* was at B where Koch's herbarium was housed prior to its destruction in 1943 (Stafleau and Cowan, 1979). Through the courtesy of the Director of B, photographs were received of the sheets from that institution which have been regarded as type material of *Fumaria muralis*. There are two sheets:

> one labelled '*F. muralis* pr. (prope) Hamburg, leg. Dr Sonder, c. 1852', with an attached slip '*F. muralis* Apr. 1850';
> and the other on a Herb. C. Bolle label '*Fumaria muralis* Hamburg, Horn, Juli (July)' Herb. W. Sonder.

LECTOTYPIFICATION

The first of the above-mentioned sheets is clearly not a type as both dates on the sheet postdate the year of publication (1845). The lack of agreement between the two dated slips is likely to have arisen through mixture of specimens. The second sheet is undated. Both sheets are undoubtedly *Fumaria muralis*, both with flowers and the Herb. Bolle sheet with a few crushed fruit remnants.

The greater part of the Sonder herbarium was purchased in 1883 by the National Herbarium of Victoria (Short 1990). Amongst the unmounted *Fumaria* material at MEL was found nine sheets of material collected by Sonder in or near Hamburg, but with the exception of two of these, they, like the material at B, either postdate the publication of the name or have insufficient information to identify them as possible types. The two sheets which are dated before 1845 include a specimen dated 19 June 1842, and a sheet from the Steetz herbarium, (see Short & Sinkora, 1988 for an account of the purchase of this herbarium). Both sheets contain the only material known with certainty to have been collected by Sonder before publication of *Fumaria muralis*.

There is no indication on either of the MEL (or B) sheets that they were seen by Koch, but there seems to be no reason to doubt that, if not syntypes, the two MEL specimens are isosyntypes of the name *Fumaria muralis* Sond. ex Koch. Importantly, they appear to be the only types that are extant and a lectotype should be chosen from them. Of the two MEL specimens, the ex-Steetz herbarium sheet is superior, the other having few attached flowers or fruit (but a number of detached organs retained within a cellophane envelope). It is labelled in Sonder's hand 'Hamburg *in muris*, Jul. 1844, W. Sonder' and annotated at length by Steetz.

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, 3141 Australia.

This specimen is superior to those photographed at B, and unlike the Bolle herbarium sheet, is dated and includes intact, mature fruit, descriptions of which are included in the protologue. Consequently, I have chosen it as the lectotype of the name *Fumaria muralis* Sond. ex Koch. I consider the remaining specimens to be possible isosyntypes (lectoparatypes or isolectoparatypes *sens.* Brummitt 1985).

Fumaria muralis Sond. ex Koch, *Syn. Fl. Germ.* ed. 2, 1017 (1845). TYPE: In muris prope Hamburgam, *Sonder s.n.* LECTOTYPE (here chosen): Hamburg *in muris*, Jul. 1844, *W. Sonder* (MEL 1584466, ex herb. *O. Steetz*). POSSIBLE SYNTYPES OR ISOSYNTYPES: Hamburg, 19 June, 1842, *Sonder* (MEL 1584465); Hamburg, Horn, Juli (no year), ex herb. *W. Sonder*, ex herb. *C. Bolle* (B).

ACKNOWLEDGEMENTS

I am grateful to the Director of the Berlin Herbarium for photographs of specimens annotated as types at that institution, to my colleagues Jim Ross, Philip Short and Doris Sinkora, and to Hansjoerg Eichler (CANB) for useful discussions and/or comments on the manuscript.

REFERENCES

Brummitt, R.K. (1985). Lectoparatypes ? *Taxon* 34:501–502.

Koch, K. (1845). *Syn. Fl. Germ.* ed. 2, 1017. (Leipzig.)

Liden, M. (1986). Synopsis of Fumarioideae (Papaveraceae) with a monograph of the tribe Fumarieae. *Opera Bot.* 88.

Short, P.S. & Sinkora, K.M. (1988). The botanist Joachim Steetz (1804–1862). *Muelleria* 6:449–494.

Short, P.S. (1990). Politics and the purchase of private herbaria by the National Herbarium of Victoria; in Short (ed) 'History of systematic botany in Australasia'. (Australian Systematic Botany Society Inc., South Yarra, Victoria.)

Stafleau, F.A. & Cowan, R.S. (1979). Taxonomic literature. Edn 2, vol. 2: H-Le. Regnum Veg. 98:1–991.

Manuscript received 20 May 1991.

TWO NEW SPECIES OF *EUCALYPTUS* (MYRTACEAE) IN SOUTH-EASTERN AUSTRALIA

by

K. RULE*

ABSTRACT

Rule, K. Two new species of *Eucalyptus* (Myrtaceae) in south-eastern Australia. *Muelleria* 7(4): 497–505 (1992). — *Eucalyptus strzeleckii* K. Rule *sp. nov.* is described and its distribution given. Comments on its ecology and conservation status are also included and comparisons are made with *Eucalyptus ovata* Labill. and *Eucalyptus brookeriana* Gray, the species with which it has affinities. The new combination, *Eucalyptus petiolaris* (Boland) K. Rule, is published for *Eucalyptus leucoxylon* F. Muell. ssp. *petiolaris* Boland. A description of the taxon is given and aspects of its morphology are discussed.

INTRODUCTION

Eucalyptus strzeleckii K. Rule is a medium to tall, forest swamp gum which grows in the western part of the Strzelecki Ranges of Victoria's South-west Gippsland region. Previous research regarded this eucalypt as an ecotype of *Eucalyptus ovata* Labill. which favors higher altitudes, whilst local observers have referred to it as *Eucalyptus brookeriana* Gray. The erection of *Eucalyptus brookeriana* in 1976 as a Tasmanian endemic species generated considerable interest in the taxonomic status of various Southern Victorian populations of forest swamp gum which resembled *Eucalyptus brookeriana*, including those of the Strzelecki Ranges. Clucas and Ladiges (1979), Ladiges, Gray & Brooker (1981) and Brooker & Lassak (1981) subsequently confirmed the presence of *Eucalyptus brookeriana* in the Otway Ranges and in the Central Highlands near Daylesford. Of particular interest is the study of Clucas & Ladiges which included a sample population from the Yarragon area on the northern fringe of the Strzelecki Ranges. They concluded that this population was an ecotype of *Eucalyptus ovata* and not *Eucalyptus brookeriana.*

The reassessment presented in this paper was initiated because other forest swamp gums observed in the Strzelecki Ranges displayed features inconsistent with *Eucalyptus ovata.* Such features included a tallish, erect habit, smooth white bark with conspicuous red-brown mottling and waxy growth tips which gave the foliage a bluish tinge. As well, these trees had a different flowering period to trees of typical *Eucalyptus ovata* growing in the same area.

Reassessment is also given to *Eucalyptus leucoxylon* F. Muell. ssp. *petiolaris* Boland whose disjunct populations occur on the Eyre Peninsula of South Australia. Previous studies by Boland (1978) and (1979) and Rule (1991) have highlighted its marked divergence from the other subspecies in both adult and juvenile characters. It is the firm opinion of this author that its current taxonomic status is anomalous and that it should be a separate species.

TAXONOMY

1. **Eucalyptus strzeleckii** K. Rule *sp. nov.*

Eucalyptus strzeleckii sp. nov. *Eucalyptus ovatae* DC. affinis a qua foliis immaturis adultis glaucis, foliis juvenilibus angustioribus glandulosioribus seminitenibus, foliis adultis et alabastris fructibusque parvioribus, cortice laevi, et habitatione altioe in differt; etiam *Eucalyptus*

* 6 Regal Court, Vermont South, Victoria, Australia 3133.

brookerianae foliis immaturis adultis glaucis, foliis juvenilibus angustioribus distincte petiolartis subcrenulatis leviter discoloribus, foliis adultis et alabastris fructibusque parvioribus, et cortice laevi.

HOLOTYPUS: 100 m from the South Gippsland Highway along the Jumbunna Road, 2.7 km from Bena towards Korumburra, 38°27′S, 145°46′E, 10.xi.1990, *K. Rule* (MEL 1598217).

Medium-sized to tall forest trees, to 30 m. *Bark* smooth throughout, whitish with red-brown mottling, with old decorticated bark sometimes persisting about the base as loose, thin sheets or strips. *Saplings and immature trees* with a substantial stocking of grey-brown sub-fibrous bark. *Seedling leaves* ovate to elliptical, decussate, shortly petiolate, slightly impressed. *Juvenile leaves* lanceolate, broad-lanceolate, elliptical or ovate, alternate, petiolate, slightly impressed, discolorous, sublustrous, green or yellow-green, subcrenulate, glandular, apiculate or acute, to 8 × 3 cm. *Lateral and intramarginal veins* visible. *Stems* usually square in cross-section by the 8th node, markedly glandular. *Petioles* to 12 mm long. *Intermediate leaves* broad-lanceolate, ovate or elliptical, slightly discolorous, glossy, green, to 14 × 6 cm, persisting in the canopy. *Growth tips* lightly to conspicuously waxy. *Adult leaves* lanceolate, broad-lanceolate, ovate-lanceolate or ovate, concolorous, glossy, dark green, markedly glandular, usually undulate, apiculate or acuminate, to 15 × 3 cm. *Petioles* to 3 cm. *Intramarginal veins* to 3 mm from the margin. *Spring growth-tips* lightly or conspicuously waxy. *Inflorescences* simple, axillary, 7-flowered. *Buds* slightly ovoid or diamond-shaped, distinctly pedicellate, to 8 × 4 mm. *Operculum* slightly longer than hypanthium, shortly beaked. *Hypanthium* slightly cupular or obconical. *Peduncles* round in cross-section or slightly angled, to 14 mm long. *Stamens* inflexed, all fertile. *Filaments* white. *Anthers* versatile, with longitudinal pores. *Style* to 5 mm long with blunted, lobed stigma. *Fruits* obconical, pedicellate, constricted below the rim, 4–5 × 5–6 mm. *Disc* prominant, raised, convex, to 1.5 mm wide. *Valves* slightly enclosed or level with rim. *Pedicels* approximately as long as fruit. *Peduncles* slender, slightly angled, to 14 mm long. *Fertile seeds* cuneate to rhomboid, black, slightly reticulate, to 1.2 × 1 mm, dorsal surface flat or slightly lacunose. *Hilum* ventral. (Figure 1)

FLOWERING TIME:
Spring.

SPECIMENS EXAMINED:

Victoria — Near Tarrago River, Longwarry District, 38°05′S, 145°52′E, 11.iii.1929, *P.R.H. St. John* (MEL577100); 6 km WSW of Mirboo North P.O., on Berrys Creek, 38°25′S, 146°05′E, 12.ii.1988, *J. Beasley*, (MEL220622); Above the railway cutting on the South Gippsland Highway, Bena, 38°25′S, 145°45′E, 10.xi.1990, *K.Rule* (MEL); Lardners Track, 5 km S of the Princes Highway, Drouin, 38°11′S, 145°03′E, 23.i.1991, *D.R. Grant* (MEL); 0.5 km along Sunny Creek Road from the Princes Highway, Trafalgar, 38°13′S, 146°09′E, 2.iii.1991, *K. Rule* (MEL); 4.5 km W of Strzelecki towards Poowong, 38°22′S, 145°52′E, 8.v.1991, *K. Rule* (MEL); 5 km E of Foster on the South Gippsland Highway, 38°39′S, 146°14′E, 10.v.1991, *K. Rule & D. McMahon* (MEL); Approx. 1 km S of Stoney Creek township, 38°06′S, 146°03′E, 10.v.1991, *K. Rule* and *D. McMahon* (MEL); Approx. 1.5 km S of Koonwarra, 38°34′S, 145°57′E, 17.v.1991, *B. Hill* (MEL); 5.8 km N of Meeniyan, 38°33′S, 146°03′E, 17.v.1991, *K. Rule* (MEL).

DISTRIBUTION:
Most of the populations of *Eucalyptus strzeleckii* occur across the western section of the Strzelecki Ranges, but populations extend to Neerim South north of Warragul. The Strzelecki Ranges are a cretaceous sandstone formation whose highest point is approximately 700 m above sea level. The annual rainfall over much of the area exceeds 1000 mm. The ranges consists mainly of rolling hills which fan out from two central ridges and which are punctuated by relatively deep, well-watered valleys. *Eucalyptus strzeleckii* favors a range of sites including ridges, slopes and along the banks of streams. Its preferred soils are grey, deep,

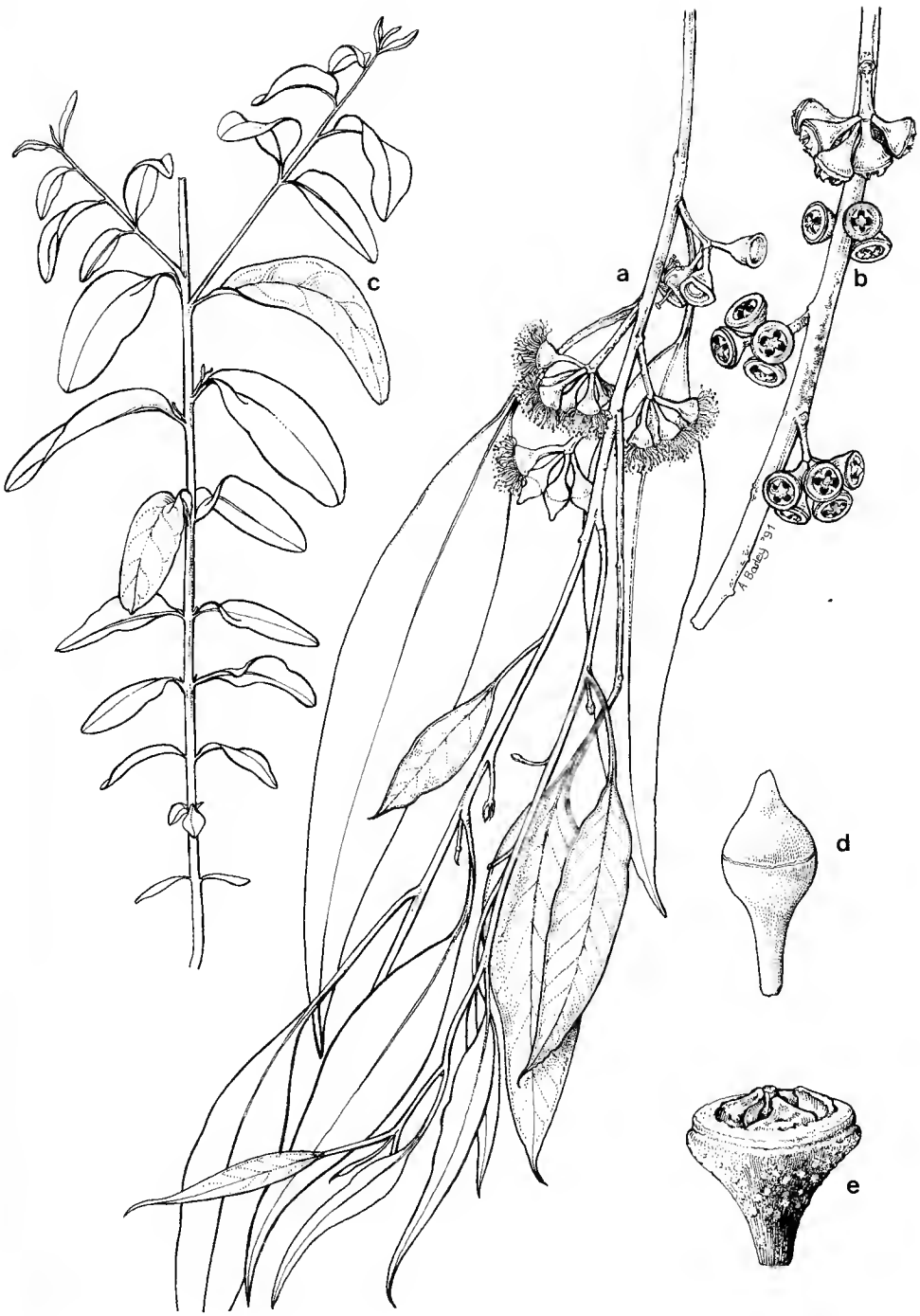


Fig. 1. *Eucalyptus strzeleckii*. a — flowering branchlet ×1. b — fruiting branchlet ×1. c — seedling ×1/3. d — bud ×3. e — fruit ×3. a, b, d, e drawn from holotype MEL 1598217; c grown from seed collected from holotype MEL 15982216.

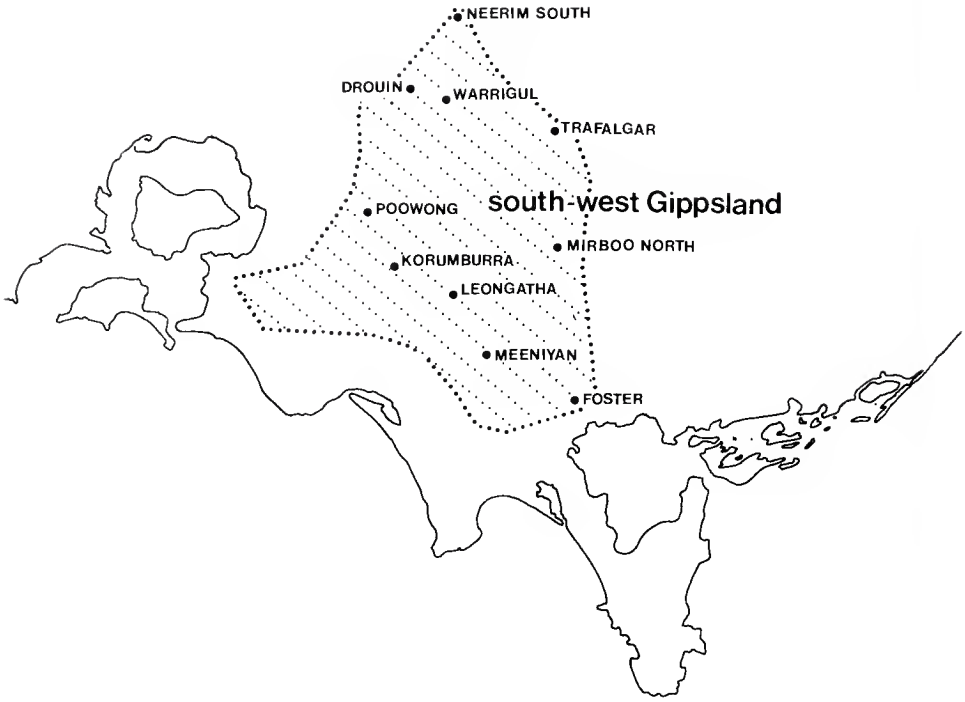


Fig. 2. Known distribution of *Eucalyptus strzeleckii*.

fertile loams which are seasonally water-logged. In a few cases it occurs on undulating or flat terrain close to creeks on the periphery of the ranges. See Figure 2.

Associated Species:

Eucalyptus strzeleckii can be associated with a number of species but more often it grows in small but pure stands. On the more elevated sites *Eucalyptus cypellocarpa* L. Johnson and *Eucalyptus globulus* Labill. are often found nearby, whilst *Eucalyptus radiata* Sieb. ex DC. and *Eucalyptus obliqua* L'Herit. are present where the terrain is undulating and drier. *Eucalyptus viminalis* Labill.is often near by where it occurs along water-courses. Occasionally it abuts *Eucalyptus ovata* on slopes adjacent to poorly drained flats or water-courses. *Eucalyptus regnans* F. Muell. is also nearby, but occupies the wettest and deepest valleys which do not appear to favor *Eucalyptus strzeleckii*.

Conservaton Notes:

At the turn of the century the Strzelecki Ranges were heavily timbered, but the demand for farming land brought about the destruction of substantial areas of forest. Despite this, remnants of *Eucalyptus strzeleckii* still occupy farms, roadside verges and small segments of public land and it remains a relatively common and widespread, although sporadic species in South-west Gippsland. In areas such as Korumburra and Poowong only individuals or small groups of trees dot the landscape and remain as monuments to past, apparently extensive populations. As yet, no substantial stands of *Eucalyptus strzeleckii* have been observed on either public or private land.

Etymology:

The epithet honors Paul Strzelecki, the explorer, who travelled through the region in 1840 and whose name was given to the ranges where the species occurs.

Table 1. Comparisons of *Eucalyptus strzeleckii* with *Eucalyptus ovata* (excluding var. *grandiflora* Blakely)* and *Eucalyptus brookeriana*.

	Eucalyptus ovata	*Eucalyptus strzeleckii*	*Eucalyptus brookeriana*
Habit:	Small to medium-sized spreading trees	Medium-sized to tall erect trees	Small to tall erect trees
Bark:	Smooth with persisting basal plates and chunks	Smooth to the ground or with basal strips and sheets	Smooth with finely fibrous stocking
Seedling stems:			
Oil glands	Moderate	Conspicuous	Conspicuous
Cross-section (6–10th nodc)	Rounded, slightly angled or square	Square	Square
Juvenile leaves:			
Shape	Ovate to orbicular	Lanceolate to ovate	Orbicular to broad-ovate
Base	Rounded to cuneate	Cuneate	Slightly cordatc or rounded
Color (upper surface)	Dull, blue-green	Semi-lustrous, yellow-green or green	Lustrous, green or dark green
Size	17 × 9 cm	To 8 × 4 cm	To 12 × 8 cm
Margin	entire or uneven	Subcrenulate	Crenulate
Discolor	Slight	Slight	Marked
Petiole length (10th node)	To 10 mm	To 12 mm	To 5 mm
Oil glands	Sparse	Abundant	Abundant
Adult leaves:			
Shape	Ovate, broad-lanceolate or broad-ovate	Lanceolate, broad-lanceolate or ovate	Lanceolate, broad-lanceolate or ovate
Size	To 20 × 5 cm	To 15 × 3 cm	To 15 × 3 cm
Margins	Entire	Entire	Entire or subcrenulate
Discolor	Absent	Absent	Absent in Victorian and Western Tas. but present Eastern Tas.
Petiole Length	To 4 cm	To 3 cm	To 3 cm
Oil Glands	Sparse	Abundant	Abundant
Buds:			
Shape	Diamond-shaped	Slightly ovoid to diamond-shaped	Slightly ovoid or diamond-shaped
Size	To 1.2 × 0.6 cm	To 0.8 × 0.4 cm	To 1.2 × 0.5 cm
Operculum	Conical or beaked	Shortly beaked	Conical or shortly beaked
Hypanthium	Obconical or turbinate	Obconical	Obconical or turbinate
Pedicel length	To 10 mm	To 8 mm	To 10 mm
Peduncle length	To 15 mm	To 14 mm	To 12 mm
Fruit:			
Shape	Obconical or turbinate	Obconical	Obconical, turbinate or slightly cupular
Size	5–8 × 5–8 mm	4–5 × 5–6 mm	5–8 × 5–7 mm
Pedicel length	2–5 mm	4–5 mm	2–5 mm
Habitat:	Usually woodland on flat, poorly drained terrain	Usually forest on wet, hilly terrain	Usually forest on wet, hilly terrain
Flowering time:	Autumn	Spring	Summer to Autumn

* *Eucalyptus ovata* var. *grandiflora* herein is regarded as a separate taxon and its recognition at the formal level of subspecies is anticipated in a future paper.

DISCUSSION:

Eucalyptus strzeleckii possesses dark green, undulating adult leaves and small, somewhat obconical fruits, and can be readily mistaken for other swamp gums, namely *Eucalyptus brookeriana* and *Eucalyptus ovata.* Only through detailed analyses of seedlings and of particular adult characters observed in the field can its distinctness be appreciated. Determinations using dried herbarium materials, however, are fraught with difficulties as *Eucalyptus strzeleckii* overlaps with these species, particularly in bud and fruit sizes. Comparisons of *Eucalyptus strzeleckii* with these other swamp gums are presented in Table 1.

Although *Eucalyptus strzeleckii* is similar to *Eucalyptus brookeriana* in its foliage and habit, other adult characters readily distinguish it from that species. Differences in fruits, buds, adult leaves and bark are subtle but their contributions to the segregation of the species should not go unmentioned.The fruits of *Eucalyptus strzeleckii* are generally smaller and regularly obconical rather than the range of shapes as in *Eucalyptus brookeriana* (turbinate, obconical or subcylindrical). As well, their pedicels are marginally more slender and longer in relation to fruit size, as are their peduncles. Whereas the buds of two are similar in most repects, those of *Eucalyptus strzeleckii* are marginally smaller. The adult leaves of the two species are similar in appearance, but those of *Eucalyptus strzeleckii* are not discolorous or crenulate in the leaf margins as in the typical form of *Eucalyptus brookeriana.* The barks of the two species also show subtle differences. *Eucalyptus strzeleckii* is smooth throughout, except for loose, persisting basal strips and sheets whereas *Eucalyptus brookeriana* regularly possesses a tessellated, finely fibrous stocking on the trunk for one or several metres. However, saplings and immature trees of *Eucalyptus strzeleckii* possess a substantial stocking of light, grey-brown, sub-fibrous bark which could cause confusion regarding identification.

In some respects the juvenile leaves of the two species resemble each other (discussed below) but are readily separable in several features. Those of *Eucalyptus strzeleckii* are only moderately crenulate, sub-lustrous, green or yellow-green, slightly discolorous, longer in the petioles, markedly longer than wide and cuneate in the base. By contrast, those of *Eucalyptus brookeriana* are strongly crenulate, lustrous and green or dark green on the upper surface, markedly discolorous, shortly petiolate, approximately as long as wide and rounded or slightly cordate in the base. The waxy growth tips of *Eucalyptus strzeleckii* are an important feature absent from *Eucalyptus brookeriana.* They occur in intermediate and coppice leaves, as well as on the mature canopy, and are particularly noticeable during spring growth spurts. The feature appears to be rare in seedlings. The amount of bloom varies and may range from being markedly conspicuous to a subtle hint which appears only in spring. Surveys have shown that trees with heavily-waxed growth-tips are most common in the Korumburra-Leongatha area but are a rarity in more northerly populations.

Typically, *Eucalyptus strzeleckii* has a tallish, erect habit and a clean, white and red-brown trunk whilst *Eucalyptus ovata* is small to medium in habit with a greyish upper trunk and substantial amounts of old basal bark retained as large, chunky plates and often appearing fibrous. Occasionally, specimens of *Eucalyptus strzeleckii* carry loose basal bark in excess which resembles the general bark-type of *Eucalyptus ovata.*

Typical seedlings of *Eucalyptus ovata* may be described as featuring a paucity of oil glands, stems often round in section and juvenile leaves that are broad-ovate to orbicular, dull, slightly discolorous, relatively long in the petioles and uneven or entire in the margins. *Eucalyptus strzeleckii* shares some of these features but its seedlings may be distinguished by the regular early development of square stems, the abundance of oil glands, the differences in leaf color and shape and a regular subcrenulation of leaf margins.

Generally the buds of *Eucalyptus ovata* are diamond-shaped with a tapered hypanthium merging into the pedicel. These contrast with the more ovoid ones of *Eucalyptus strzeleckii* which can be readily distinguished from their pedicels.

There is some overlap in fruit sizes, but those of *Eucalyptus ovata* are usually larger. This is particularly evident in those populations which abut *Eucalyptus strzeleckii*. As well, they may be sessile or distinctly pedicellate, unlike the uniformly pedicellate ones of *Eucalyptus strzeleckii*. The peduncles of the two species, although similar in length, are different in that those of *Eucalyptus ovata* are appreciably thicker than those of *Eucalyptus strzeleckii*.

There are also differences in the adult leaves with those of *Eucalyptus ovata* usually being larger, although the persisting, large intermediate leaves, which tend to dominate the canopy of *Eucalyptus strzeleckii*, may give wrong impressions regarding maximum sizes. Further, the adult leaves of *Eucalyptus ovata* are relatively sparse in oil glands and appreciably less aromatic than those of *Eucalyptus strzeleckii*. Above all, the two species are readily distinguished by the waxy growth tips which are present in *Eucalyptus strzeleckii* and not in *Eucalyptus ovata*.

Both *Eucalyptus ovata* and *Eucalyptus strzeleckii* have well-separated flowering periods, implying long-established breeding barriers. So far, no breakdown in adult or juvenile morphology has been observed in *Eucalyptus strzeleckii* where its populations abut those of *Eucalyptus ovata*. Despite this, it remains a possibility that some exchange of genes has occurred in the past, remembering that *Eucalyptus strzeleckii* abuts *Eucalyptus ovata* on numerous fronts of its distribution.

Clearly *Eucalyptus ovata* and *Eucalyptus brookeriana* are close relatives of *Eucalyptus strzeleckii* The fact that all three species are similar in a range of adult characters tends to reinforce this position on affinity. Obviously, the presence of surface wax in *Eucalyptus strzeleckii* reflects that it is following its own evolutionary path. Whether it diverged from *Eucalyptus ovata* or *Eucalyptus brookeriana* is open to speculation. The abundance of oil glands,the consistent, early development of square stems, the subcrenulate leaf margins and the slight lustre in its seedlings, as well as the similarities in bark, could lead to the interpretation that *Eucalyptus brookeriana* is closer. However, other seedling features, such as relatively long petioles, cuneate bases and limited discolor, might suggest it is nearer to *Eucalyptus ovata*. Further research may resolve this question of affinity.

Key to the species of Swamp Gum in southern Victoria

1. Small trees with fibrous bark to the upper branches.....*Eucalyptus yarraensis*
1. Small, medium or tall trees with smooth bark on most of the trunk.....2

2. Juvenile leaves bluish, dull, margins entire or uneven, lightly glandular; adult leaves also lightly glandular; small to medium, spreading woodland trees
.....*Eucalyptus ovata*
2. Juvenile leaves yellow-green, green or dark green, lustrous or semi-lustrous, crenulate or subcrenulate, conspicuously glandular; adult leaves also markedly glandular; medium to tall, erect forest trees.....3

3. Juvenile leaves lanceolate, broad-lanceolate or ovate, cuneate in the base; growth tips of intermediate, coppice and adult leaves lightly or conspicuously waxy; basal bark smooth, shed as strips or sheets
.....*Eucalyptus strzeleckii*
3. Juvenile leaves ovate to orbicular, rounded to slightly cordate in the base; all growth tips non-waxy; basal bark finely fibrous, tessellated
Eucalyptus brookeriana

2. **Eucalyptus petiolaris** (Boland) K. Rule *comb. et stat. nov.*
Basionym: *Eucalyptus leucoxylon* F. Muell. ssp. *petiolaris* Boland, *Australian Forest Research*, 9: 65–72 (1979).

Holotypus: Pillaworta Creek near Pillaworta Hill, South Australia, 15 May, 1971, *D.J. Boland 690* (FRI).

DESCRIPTION:

Robust mallees or small trees. *Bark* smooth,grey or white sometimes with a loose, sub-fibrous basal stocking. *Seedling leaves* subsessile, ovate-elliptical, decussate 3 to 5 pairs, blue-green, discolorous. *Juvenile leaves* dull, blue-green, broad-lanceolate or ovate, petiolate, alternate, to 7 × 5 cm. *Adult leaves* lanceolate, green, semi-lustrous, to 15 × 2.5 cm. *Petioles* to 2 cm. *Buds* ovoid, cylindrical or slightly clavate. *Hypanthium* tapering into pedicel, prominently ribbed, to 15 × 8 mm. *Ovular rows* per locule 6–8. *Operculum* conical to slightly beaked, lightly ribbed. *Pedicels* approximately as long as buds. *Fruits* campanulate, subcampanulate or subcylindrical, lightly or conspicuously ribbed, to 16 × 14 mm. *Locules* 5 or 6. *Valves* to 4 mm below rim. Base of detached style surrounded by a conspicuous collar of lobes. *Pedicel* to 18 mm.

SPECIMENS EXAMINED:

South Australia — 4 miles E of Coomunga, 34°39′S, 145°48′E, 12.x.1958, *D.J.E. Whibley 369* (AD); 'Glenville', 25 km west of Cowell, 33°37′S, 136°40′E, 15.i.1973, *D.A. Kleinig 40* (FRI); On south ridge of Carapee Hill, 16.v.1973, *D.J. Boland* (FRI); Darke Peak, 16.v.1973, *D.J. Boland* (FRI); *c.* 15 km N of Port Lincoln, 34°35′S, 135°52′E, 26.xi.1976, *N.C. Collinson 205* (AD97717413); Southern Eyre Peninsula, 34°35′S, 135°50′E, 10.ii.1977, *N.C. Collinson* (AD98760984); West of Cowell on Cleve Road, Pootitnie Hill, 33°40′S, 136°39′E, 14 vi 1983, *D. Blaxell & L. Johnson*, (NSW).

FLOWERING TIME:

Winter.

DISTRIBUTION:

Eucalyptus petiolaris is endemic to the Eyre Peninsula of South Australia and has two main areas of distribution; one in the vicinity of Port Lincoln and the other near Cleve. It favours loamy soils on hilly or undulating terrain or may occur on rocky outcrops, for example, at Carapee Hill to the north-west of Cleve.

CONSERVATION NOTES:

A species of a somewhat restricted distribution, *Eucalyptus petiolaris* is regarded as by no means plentiful. Its numbers have been depleted because of clearing for agriculture and its remnants are now confined to farms, roadsides and a few flora reserves, for example, in the Wanilla State Forest near Port Lincoln and at Carapee Hill Conservation Park near Darke Peak.

ETYMOLOGY:

The subspecific epithet, which alludes to the petiolate juvenile leaves of the species, is maintained.

DISCUSSION:

Eucalyptus petiolaris was erected as a subspecies within *Eucalyptus leucoxylon* by Boland (1979) who emphasised the divergent nature of its juvenile leaves,buds and fruits. Boomsma (1981), Chippendale (1988) and Brooker and Kleinig (1990) also referred to these distinguishing features, as did Rule (1991) who alluded to a possible reassessment of its status.

The populations of *Eucalyptus petiolaris* are geographically separated from the subspecies of *Eucalyptus leucoxylon* and no evidence of gradation has been observed. It differs from *Eucalyptus leucoxylon* in not possessing opposite, sessile juvenile leaves, which are features that bind the various subspecies together. In addition, the conspicuously ribbed buds, whose locules each possess 6–8 ovular rows, rather than 4 to 6 in the case of *Eucalyptus leucoxylon* and its subspecies,and its large, often conspicuously ribbed, campanulate fruits, with their conspicuous collar of lobes over the valves, contribute to its uniqueness.

Eucalyptus petiolaris is also one of the few eucalypts which possesses a wide range of flower colors. Although cream is the dominant color, red, pink, apricot and yellow flowers have also been observed.

The rapid development of petiolate, alternate juvenile leaves in *Eucalyptus petiolarisis* viewed as one of the important criteria in its erection as a species. However, differences in leaf ontogeny have been used before in *Eucalyptus* taxonomy. Marginson and Ladiges (1988), for example, found that coastal populations of *Eucalyptus baxteri* (Benth.) Maiden & Blakely *ex* J. M. Black had an appreciably shorter period of juvenility than desert populations and highlighted this difference in their case for the erection of *Eucalyptus arenacea* Marginson & Ladiges as a new species. Fortunately, as in the case of *Eucalyptus arenacea*, *Eucalyptus petiolaris* has not been raised to a species only on the basis of a difference in leaf ontogony. *Eucalyptus petiolaris* is regarded as being closely related to *Eucalyptus leucoxylon* on the basis of many shared features and it is suggested that the erection of an informal Superspecies *leucoxylon* would accommodate this level of affinity.

ACKNOWLEDGEMENTS

Sincere thanks are given to M.H.I. Brooker, CSIRO, Canberra, for his advice during this project and for the Latin description. The assistance of several members of staff at the National Herbarium, Melbourne, is gratefully acknowledged. These include Don Foreman for his assistance with the preparation of the manuscript, David Albrecht for his many helpful perspectives and Anita Barley for the excellent illustrations. Special recognition is given to C.D. Boomsma, Adelaide, for his advice and many personal communications over the years regarding *Eucalyptus petiolaris* and *Eucalyptus leucoxylon* and to Mr. Alf Salkin, Mt-Waverley, Victoria, for his donation of materials of *Eucalyptus petiolaris*. I am also grateful to Don McMahon of Blackburn, Barry Hill of Koonwarra and Don Grant of Drouin, all of Victoria, for their assistance in the collection of specimens of *Eucalyptus strzeleckii* and for their advice regarding the location of many of its populations.

REFERENCES

Boland, D.J. (1978), Geographic Variation in *Eucalyptus leucoxylon* F. Muell., *Aust. For. Res.*, 8: 25–46.

Boland, D.J. (1979), Taxonomic revision of *Eucalyptus leucoxylon* F. Muell., *Aust. For. Res.* 9: 65–72.

Boomsma, C.D. (1981), 'Native Trees Of South Australia Bulletin No 19' (S.A. Woods And Forests Dept: Adelaide.)

Brooker, M.I.H. & Lassak E.V., (1981), The volutile leaf oils of *Eucalyptus ovata* and *Eucalyptus brookeriana* A.M. Gray (Myrtaceae), *Aust. J. Bot.*, 29: 605–15.

Chippendale, G.M. (1988), Myrtaceae — *Eucalyptus* and *Angophora*, 'Flora Of Australia', (Australian Government Printing Service: Canberra.), pp. 1–540.

Clucas, R.D. & Ladiges, P.Y., Variations in populations of *Eucalyptus ovata* Labill. and the effects of waterlogging on seedling growth, *Aust. J. Bot.*, 27: 301–15.

Gray, A.M. (1979), A new species of *Eucalyptus* from Tasmania, *Aust. For. Res.*, 9: 111–18.

Ladiges, P.Y., Gray, A.M. & Brooker, M.I.H. (1981), Pattern of geographic variation, based on seedling morphology, in *Eucalyptus ovata* Labill. and *Eucalyptus brookeriana* A.M. Gray and comparisons with some other species, *Aust. J. Bot.*, 29, 593–603.

Marginson, J.C. & Ladiges, P.Y. (1988), Geographical variation in *Eucalyptus baxteri s.l.* and recognition of a new species, *Eucalyptus arenacea*, *Aust. Syst. Bot.*, 1: 151–70.

Rule, K., (1991), Two new subspecies of *Eucalyptus leucoxylon* F. Muell. and notes on that species, *Muelleria*, 7(3): 389–403.

Manuscript received 22 May 1991.

A NEW SPECIES AND NEW RECORDS FROM THE TASMANIAN LICHEN FLORA

by

GINTARAS KANTVILAS[1] & JOHN A. ELIX[2]

ABSTRACT

Kantvilas, Gintaras & Elix, John A. A new species and new records from the Tasmanian lichen flora. *Muelleria* 7(4): 507–517 (1992). — A new lichen from Tasmania and South Australia, *Neofuscelia subloxodella* Elix & Kantvilas, is described. Twenty-three additional lichen taxa are reported from Tasmania for the first time, and notes on their distinguishing features, distribution and ecology are provided. The new combination, *Parmelina pseudorelicina* (Jatta) Kantvilas & Elix, is proposed.

INTRODUCTION

Since the publication of the last inventory of Tasmanian lichens (Kantvilas 1989), floristic, ecological and taxonomic research on the flora has continued, resulting in many additions and alterations to the Tasmanian census. In the present paper, we describe a new terricolous species in the genus *Neofuscelia* and report twenty-three lichen taxa from Tasmania for the first time. Included are the first Tasmanian records for the genera *Candelaria*, *Erioderma*, *Graphina*, *Imshaugia*, *Parmeliopsis*, *Tomasellia* and *Zahlbrucknerella*.

METHODS

The study is based primarily on collections in the Tasmanian Herbarium supplemented by material from some other herbaria. For all taxa, determinations are based on comparisons with type and/or reliably identified reference material and, where appropriate, personal communication with specialists in their respective groups (see acknowledgements). Anatomical and chemical investigations follow standard methods.

THE SPECIES

1. **Arthopyrenia anisoloba** Müll. Arg., *Flora* 66: 305 (1883).

Thallus very thin, effuse, scurfy, UV−. *Perithecia* scattered, black, hemispherical, 0.2–0.3 mm wide. *Asci* 8-spored, cylindrical, 60–80 × 16–20 µm, with a short, broad, flattened ocular chamber. *Spores* ovate, hyaline, unequally 1-septate (10)–12–19 × (4–) 5–8 µm. *Paraphyses* slender, persistent, anastamosing, *c.* 0.8 µm thick.

With its 1-septate, ovate spores, *A. anisoloba* appears to belong to the Section *Anisomeridium* (see Müller 1883, Coppins 1988: 306) and will ultimately require transferring to another genus (A. Aptroot pers. comm.). However, at present *Arthopyrenia s.lat.* in Tasmania remains very poorly known, both at generic and species level, although a large number of taxa have been collected. *A. anisoloba* is an inconspicuous species, known in Tasmania from several widely scattered localities in cool temperate rainforest. It occurs on the smooth bark of *Atherosperma*, *Nothofagus*, *Phyllocladus* and *Lagarostrobos* in deeply shaded habitats, and

[1] Gintaras Kantvilas, Tasmanian Herbarium, G.P.O. Box 252C, Hobart, Tasmania, 7001 Australia.
[2] John A. Elix, Department of Chemistry, Australian National University, P.O. Box 4, Canberra, ACT, 2601 Australia.

associated lichens include *Phlyctis subuncinata*, *Arthothelium ilicinum*, *Bacidia weymouthii*, *Thelotrema lepadinum* and species of *Arthonia* and *Pyrenula*. *Arthopyrenia anisoloba* was orginally described from Brazil.

Specimens Examined:

Tasmania — Weindorfers Forest, Waldheim, 920 m, 9 February 1988, *G. Kantvilas 19/88* (HO,NY,LSU); Badger Creek, *c.* 2.5 km south of Greystone Bluff, 280 m, 17 February 1989, *G. Kantvilas 71/89* (HO); Anthony Road, 560 m, 16 December 1988, *G. Kantvilas 568/88* (HO); Five Road, Florentine Valley, 450 m, 10 April 1981, *G. Kantvilas 231/81* (HO,BM). Approximately 3 km south of Teepookana, 220 m, 7 November 1990, *G. Kantvilas* 671/90 (HO).

2. **Arthothelium ampliatum** (Knight & Mitten) Müll. Arg., *Bull. Herb. Boissier 2*, App. 1: 85 (1894). — *Arthonia ampliata* Knight & Mitten, *Trans. Linn. Soc. Lond.* 23: 106 (1860).

Arthothelium ampliatum is characterised by its distinctive spores, 30–37 × 10–14 µm, with a muriform tail and markedly enlarged, undivided, terminal cell (see Kantvilas 1990 for description, discussion and illustration). It is apparently uncommon in Tasmania where it has been recorded from the bark of *Pomaderris* in wet sclerophyll forest. The species is also known from New South Wales, New Zealand and Victoria.

Specimens Examined:

Tasmania — Maria Island, 1.5 km north west of Mt Maria, 350 m, 11 March 1981, *G. Kantvilas 167/81* (HO); Strickland Avenue near Hobart, 180 m, 4 August 1906, *W.A. Weymouth 968* (HO).

3. **Candelaria concolor** (Dickson) B. Stein *in* Cohn, *Krypt. Fl. Schlesien* 2: 84 (1879). — *Lichen concolor* Dickson, *Fasc. pl. cryptog. brit.* 3: 18 (1793).

Candelaria concolor is a widespread cosmopolitan lichen, recognised by its citrine yellow to yellow-green, K − thallus with minute lobes and marginal soredia (see Galloway 1985 for full description). In mainland Australia, this species is particularly abundant on exotic trees, but in Tasmania it is quite uncommon and known currently only from sandstone outcrops in dry sclerophyll forest. Apothecia are unknown in Tasmanian specimens.

Specimens Examined:

Tasmania — Old Beach Road opposite Cadburys, 50 m, 5 February 1984, *G. Kantvilas & P. James 283/84* (HO,BM); Hunting Grounds, Dysart, 400 m, 7 August 1981, *G. Kantvilas 485/81* (HO,BM).

4. **Cladonia macilenta** Hoffm., *Deutchl. Fl.* 2: 126 (1796).

Despite misapplication of its name in the past, this species is now confirmed in Tasmania. It is apparently rare in the State and occurs on sandy soil in dry sclerophyll forest. *C. macilenta* is characterised by red-fruited, mainly ecorticate, farinose sorediate podetia and a chemistry comprising barbatic acid, ± didymic, thamnolic, squamatic or consquamatic acids (Archer 1988). Tasmanian specimens contain barbatic and thamnolic acids only, and occur together with *C. floerkeana*, a closely related species with rough, corticate podetia.

Specimens Examined:

Tasmania — Taylors Tier, *c.* 2 km south-east of Pelham, 340 m, 20 October 1990, *G. Kantvilas & J. Jarman 341/90* (HO); same locality, 20 February 1991, *G. Kantvilas & J. Jarman 8/91* (HO); Bluff Road, *c.* 5 km north-east of Tanina Bluff, 20 February 1991, *G. Kantvilas & J. Jarman 1/91, 2/91* (HO).

5. **Cladonia neozelandica** Vainio, *Acta Soc. Faun. Fl. fenn.* 10: 34 (1894).

Tasmanian specimens of *Cladonia* consisting entirely of basal squamules and containing atranorin only are here identified as *C. neozelandica* [see Galloway

(1985) for full description and Archer & Bartlett (1986) for diagnostic characters]. This species is most easily confused with *C. sulcata* which also occurs frequently as mats of squamules lacking podetia. However, the squamules of *C. neozelandica* tend to be mostly < 2 mm long and noticeably smaller than those of *C. sulcata* which, in variety *wilsonii*, can be up to 10 — 15 mm long. Chemistry provides the most reliable means of identification:

> *C. sulcata* contains bourgeanic acid in addition to atranorin (Archer & Bartlett 1986), with var. *wilsonii* also containing stictic acid, var. *sulcata* containing psoromic acid and var. *striata* (not present in Tasmania) containing norstictic acid.

There are also some ecological differences:

> *C. neozelandica* has been recorded from dry sclerophyll forest whilst *C. sulcata* occurs mostly in high rainfall areas, var. *sulcata* being mostly subalpine to alpine.

Specimens Examined:

Tasmania — Prosser River, sea level, 23 October 1980, *G. Kantvilas 313/80* (HO,BM); Sepentine Hill, 280 m, 26 September 1986, *G. Kantvilas s.n.* (HO).

6. **Degelia duplomarginata** (P. James & Henssen) Arvidsson & Galloway, *Lichenologist* 13: 39 (1981). — *Parmeliella duplomarginata* P. James & Henssen, *Mycotaxon* 11: 221 (1980).

Degelia duplomarginata is a distinctive species, distinguished from others in the genus by the presence of lobules in the centre of the thallus which coalesce and form a secondary thalline margin around the apothecia (see Henssen & James 1980, Arvidsson & Galloway 1981). Known from New Zealand, South America and Hawaii (Jørgensen & James 1990), this species is rare in Tasmania and has been recorded from a single locality only. It occurred on the canopy limbs of *Atherosperma moschatum* in cool temperate rainforest, associated with typical canopy species from the genera *Hypogymnia*, *Menegazzia*, *Parmelia* and *Usnea*. It is thus ecologically distinct from its nearest relative, *Degelia gayana*, which occurs mainly in wet heathland and scrub at forest margins, and which associates mostly with cyanophilic species of Lobariaceae and Pannariaceae.

Specimen Examined:

Tasmania — Meander Forest Reserve, 680 m, 13 May 1990, *G. Kantvilas 219/90* (HO,BM).

7. **Erioderma sorediatum** D. Galloway & P.M. Jørg., *Lichenologist* 7: 139 (1975).

Erioderma sorediatum is a palaeotropical species characterised by involute lobes which are greyish brown when dry, blue-grey when wet, and by a tomentose upper surface, whitish ecorticate lower surface and abundant bluish granular soredia on the lower surface, especially at the lobe margins (see Galloway & Jørgensen 1975 for complete description). The Tasmanian specimen is atypical, with rather larger than usual, cuneate lobes to *c.* 1–1.5 cm wide, almost completely lacks tufted rhizines on the lower surface, contains eriodermin and reacts Pd + faint orange; it nevertheless falls within the range of variation of this species (P.M. Jørgensen pers. comm.).

Tiny juvenile thalli of this taxon have been noted in Tasmania in the past, but the material was never sufficient to confirm the identification until now. *E. sorediatum* occurs in a very diverse, distinctive association of cyanophilic lichens found in very wet areas at the margins of rainforest on the fibrous bark of the shrubs, *Cassinia aculeata* and *Helichrysum* species (Asteraceae). Associated lichens include species from the genera *Collema*, *Degelia*, *Fuscoderma*, *Leioderma*, *Leptogium*, *Parmeliella*, *Pseudocyphellaria* and *Psoroma*.

Specimen Examined:

Tasmania — Savage River Pipeline Road, north of Donaldson River, 25 May 1990, *G. Kantvilas 259/90* (HO,BG).

8. **Graphina subvelata** (Stirton) Zahlbr., *Catal. lich. univ.* 2: 428 (1924). — *Graphis subvelata* Stirton, *Qld. agric. J.* 5: 488 (1899).

Graphina subvelata is characterised by a thin, pale grey thallus, prominent lirellae with carbonised exciples with an open base, and muriform, ellipsoid spores, 25–32 (–40) × 11–16 (–18) µm with (5–) 7–9 (–11) transverse and 0–4 longitudinal septa (see Hayward 1977 for full description). It contains no substances detectable by TLC. The single Tasmanian specimen is from a twig of *Ulmus* in parkland. The species also occurs in New Zealand and mainland Australia.

Specimen Examined:

Tasmania — Westbury Green, 15 November 1977, *R.D. Seppelt 5294* (HO).

9. **Hypogymnia pulchrilobata** (Bitter) Elix, *Brunonia* 2: 214 (1979). — *Parmelia pulchrilobata* Bitter, *Hedwigia* 40: 244 (1901).

Hypogymnia pulchrilobata is characterised by short, broad, hollow, contiguous lobes, rather inflated, urceolate apothecia and by a PD−, white medulla (see Elix 1979 for full description and discussion). The species is found mostly in the drier parts of southern Australia and New Zealand and appears to be genuinely rare in Tasmania. The single record is from a charred eucalypt log in *Eucalyptus obliqua* open forest. Associated lichens included *Cladonia rigida*, *Hypocenomyce australis*, *H. foveata*, *Hypogymnia pulverata*, *H. turgidula* and *Ochrolechia* sp.

Specimen Examined:

Tasmania — Bermuda Road, 12 km north of Geeveston, 440 m, 25 October 1990, *G. Kantvilas & J. Jarman 596/90* (HO).

10. **Imshaugia aleurites** (Ach.) S.F. Meyer, *Mycologia* 77: 338 (1985). — *Lichen aleurites* Ach., *Lichenogr. Suec. Prodr.* : 117 (1798).

Imshaugia aleurites is characterised by a small, foliose, orbicular thallus with pale grey upper surface and pale fawn underside, granular to cylindrical isidia, densely clustered towards the centre of the thallus, and by the presence of atranorin and thamnolic acid (see Thomson 1984 for full description). In Tasmania, this species forms neat rosettes to *c.* 4 cm wide and may resemble some smaller species of *Parmelinopsis* which differ in having a C+ red or pink medulla, black undersurface and black marginal cilia.

Imshaugia aleurites is widespread on conifers and fence posts in the cool temperate and montane regions of the world e.g. in Europe, North America and Africa. It also occurs in Victoria in montane areas on dead wood (Elix 1990). It has as a similar ecology in Tasmania and occurs on the bark and wood of exposed, bleached trunks of the endemic conifer, *Athrotaxis cupressoides* (Taxodiaceae), in open montane forest. Associated lichens include *Usnea inermis*, *Hypogymnia lugubris* and species of *Mycoblastus* and *Ochrolechia.*

Specimen Examined:

Tasmania — Pine Lake, 1200 m, 4 June 1989, *G. Kantvilas 191/89* (HO,ANUC).

11. **Melanelia piliferella** (Essl.) Essl., *Mycotaxon* 7: 48 (1978). — *Parmelia piliferella* Essl., *Journ. Hattori Bot. Lab.* 42: 83 (1977).

Melanelia piliferella is a small, tightly adpressed, brown, parmelioid species characterised by rather crowded, simple to branched, cylindrical isidia, minute

hyaline cortical hairs at the lobe apices and on the isidia, a HNO_3+ reddish cortex and by the presence of gyrophoric acid (medulla C+ rose) (see Esslinger 1977 for full description). It is only the second species of the genus to be recorded from Tasmania, the other being *M. subglabra* (Räs.) Essl., a corticolous sorediate species found mainly in rainforest.

Although usually corticolous, *M. piliferella* was collected in Tasmania from soft, weathered sandstone in dry sclerophyll forest. Associated species included *Acarospora citrina*, *Flavoparmelia haysomii*, *Parmelia signifera*, *Pseudocyphellaria crocata* and species of *Neofuscelia* and *Xanthoparmelia*.

Specimen Examined:

Tasmania — Hunting Grounds, *c.* 4.5 km west of Dysart, 400 m, 7 October 1981, *G. Kantvilas & P. James 480/81* (HO,BM).

12. **Neofuscelia parviloba** (Essl.) Essl., *Mycotaxon* 7: 51 (1978). — *Parmelia parviloba* Essl., *Journ. Hattori Bot. Lab.* 42: 129 (1977).

This species is characterised by the diminutive subcrustose thalli which form small rosettes to 1.5 cm diameter (sometimes coalescing into larger patches), the absence of soredia and isidia, and the presence of medullary fumarprotocetraric and protocetraric acids (cortex K−, HNO_3+ dark blue-green; medulla PD+ orange red, K+ yellow turning brownish orange). These characters are also found in *N. stygiodes* (Nyl. ex Crombie) Essl., a wide-ranging species of cold, wet habitats and common in the mountains of western and central Tasmania. However, *N. parviloba* has a flatter, thinner thallus, a pale lower surface and scattered rhizines (*N. stygiodes* has a black-brown lower surface and loboid holdfasts rather than rhizines). *N. parviloba* is also known from New South Wales and the Australian Capital Territory. It is apparently uncommon in Tasmania, where it was collected from sandstone rocks in dry sclerophyll forest.

Specimen Examined:

Tasmania — Grass Tree Hill, 400 m, 14 August 1981, *G. Kantvilas 727/81* (HO).

13. **Neofuscelia subloxodella** Elix & Kantvilas *sp. nov.*

Thallus ut in Neofuscelia loxodella sed pagina inferiore straminea vel brunnea et isidiis globosis, inflatis, apicibus saepe erumpentibus differt.

Typus: Australia, Tasmania — Cape Deslacs, 42°59′S, 147°33′E, on soil in dry coastal heathland, sea level, 1 June 1980, *G. Kantvilas 230/80* (Holotypus: HO; Isotypi: BM,LSU).

Thallus foliose, terricolous, moderately to tightly appressed to the substrate, *c.* 2–3 cm diameter; lobes irregular, 1.0–2.0 mm wide, short, rounded, imbricate. *Upper surface* olive-brown to dark brown, smooth and strongly glossy at the lobe apices, becoming dull and cracked on older parts of the thallus, soredia absent, densely isidiate; isidia globose then cylindrical, simple at first but expanding laterally and becoming sparingly branched, ultimately the apices becoming inflated and rarely erumpent, not sorediose; medulla white. *Lower surface* dull, pale tan to brown, moderately rhizinate, rhizines concolorous with the lower surface, to 0.3 mm long. *Apothecia* not seen. (Figure 1)

Chemistry: Thallus K−, HNO3+ dark blue-green; medulla K−, C−, KC+ pink turning orange, P−; containing glomelliferic, glomellic and loxodellic acids.

In Australia, there are three species of *Neofuscelia* that produce medullary glomelliferic, glomellic and loxodellic acids, namely *N. loxodella*, *N. waiporiensis* and *N. subloxodella*. The new species is readily distinguished by its pale lower surface (black in the other two taxa) but, like *N. waiporiensis*, develops inflated isidia which ultimately becomc erumpent. It co-occurs with *N. loxodella* which

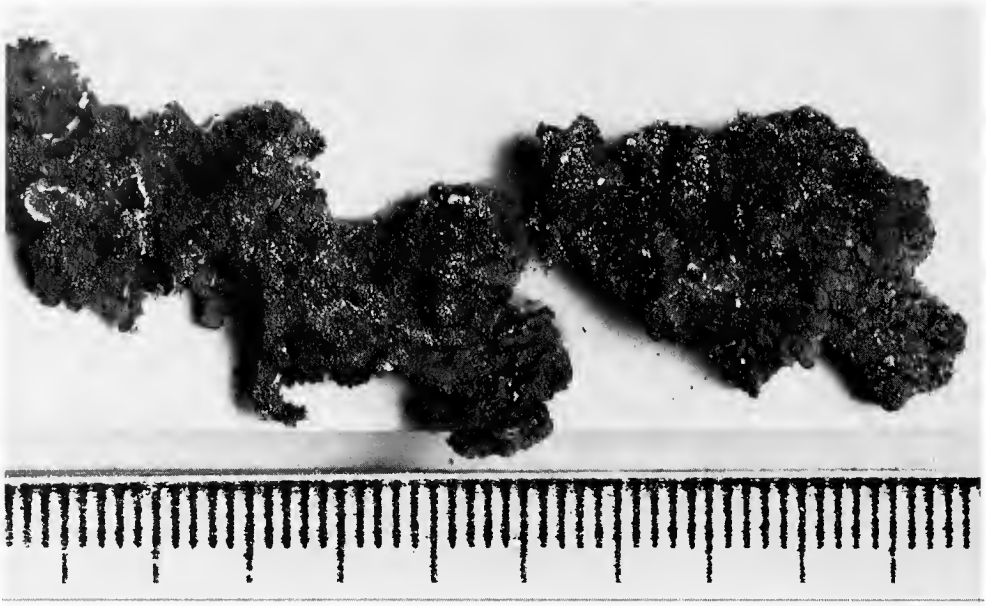


Figure 1. *Neofuscelia subloxodella* Elix & Kantvilas. Holotype *Kantvilas 230/80*. Scale in mm.

has typical cylindrical, non-erumpent isidia. *N. subverrucella*, another isidiate Australian species with a pale brown lower surface, differs from *N. subloxodella* in producing medullary divaricatic acid and by developing cylindrical isidia which do not become inflated or erumpent.

ADDITIONAL SPECIMEN EXAMINED:

South Australia — Mt Kinke, Gairdner-Torrens Basin, Region 4, 7 October 1987, *D.E. Symon 14801* (AD 19121).

14. **Nephroma cellulosum** var. **isidioferum** J. Murray, *Trans. R. Soc. N.Z.* 88: 385 (1960).

Recently recorded for the first time from the Australian mainland (Kantvilas 1990), this taxon is uncommon in Tasmania in comparison to the very abundant typical variety (see White & James 1988 for description of both taxa). It is distinguished by the presence of squamiform phyllidia, found mainly on the ridges of the faveolate thallus. In Tasmania, both varieties are found in rainforest, wet sclerophyll forest and wet scrub where they occur as epiphytes or occasionally on rocks.

SPECIMENS EXAMINED:

Tasmania — Mt Penny, 4 April 1969, *G.C. Bratt & K. McKay 69/165a* (HO); Leslie Creek, 6.4 km east of Zeehan, 160 m, 12 June 1965, *G.C. Bratt & J.A. Cashin 2366* (HO); Tarraleah, 600 m, 30 August 1980, *G. Kantvilas 336/80 p.p.* (HO).

15. **Parmelina conlabrosa** (Hale) Elix & Johnston, *Brunonia* 9: 159 (1986). — *Pseudoparmelia conlabrosa* Hale, *Smithsonian Contr. Bot.* 31: 25 (1976).

Parmelina conlabrosa is characterised by a grey, tightly adnate thallus, abundant rather crowded, cylindrical isidia, and by the presence of lecanoric acid in the medulla (see Filson 1982, Hale 1976a for a full description). The species is locally abundant in Tasmania in dry sclerophyll forest, typically occurring on subdominant trees such as *Exocarpos*, *Banksia*, *Acacia* and *Casuarina*; one collection is from mudstone rocks. It is rather variable, and ranges from individuals with

rather rounded contiguous lobes, centrally densely isidiate, to individuals with rather dispersed sublinear lobes with sparse isidia. The axillary cilia which characterise the genus *Parmelina* are invariably very sparse in this species (see also Elix & Johnston 1986, Elix & Hale 1987).

Parmelina conlabrosa is the isidiate counterpart of the very widespread Australian corticolous species now correctly known as *Parmelina pseudorelicina* (Jatta) Kantvilas & Elix (see below).

SPECIMENS EXAMINED:

Tasmania — Three Thumbs, *c.* 5 km south of Orford, 480 m, 12 October 1989, *G. Kantvilas 204/89* (HO). Grass Tree Hill, 400 m, 14 October 1981, *G. Kantvilas & P. James 707/81* (HO,BM). Bensemans Road, north of Exton, 200 m, 7 November 1980, *G. Kantvilas 568/80, 585/80* (HO,BM). Levendale, 360 m, 1 October 1981, *G. Kantvilas 442/81* (HO,BM). Cape Deslacs, 30 m , 18 July 1981, *G. Kantvilas 430/81* (HO,BM). Square Mountain near Sorell, 150 m, 5 April 1981, *G. Kantvilas 228/81 B* (HO).

Parmelina pseudorelicina (Jatta) Kantvilas & Elix *comb. nov.*

BASIONYM: *Parmelia pseudorelicinia* Jatta, *Bull. Soc. Bot. Ital.* 1910: 254 (1911). HOLOTYPUS: Tasmania, 'ad Sassafrages in Monte Wellington (Hobart Rivulet), alt 600 p'[180 m], *W.A. Weymouth* (NAP!).

SYNONYM: *Parmelina stevensiana* Elix & Johnston, *Brunonia* 9: 157 (1986).

This very common and widespread Australasian corticolous lichen has previously also been referred to (incorrectly) as *Parmelia pruinata* Müll. Arg. or *Parmelina pruinata* (Müll. Arg.) Hale [=*Canoparmelia pruinata* (Müll. Arg.) Elix & Johnston] (Filson 1982, Galloway 1985), which is a relatively uncommon species from South Australia and Western Australia. A full description, discussion and illustration of *Parmelina pseudorelicina* (as *P. stevensiana*) is provided by Elix & Johnston (1986). The type specimen is a fragment of a young, infertile thallus and contains atranorin and lecanoric acid.

Parmelina pseudorelicina is a common epiphyte in Tasmania in wet sclerophyll and dry sclerophyll forest, particularly on species of *Acacia*. It is frequently associated with *Flavoparmelia rutidota*, *Lecidea laeta*, *Menegazzia caesiopruinosa, M. platytrema, M. subpertusa, Parmelia cunninghamii, P. tenuirima, Parmelinopsis afrorevoluta, Pertusaria gibberosa, Punctelia subrudecta, Ramalina inflata, R. unilateralis, Usnea inermis* and *U. scabrida*. It may occur also in rainforest as an infrequent canopy species. One collection from coastal heathland (Cape Deslacs) is from mudstone.

16. **Parmelinopsis minarum** (Vainio) Elix & Hale, *Mycotaxon* 29: 243 (1987). — *Parmelia minarum* Vainio, *Acta Soc. Faun. Fl. fenn.* 7: 48 (1890).

Morphologically this species resembles *Parmelina conlabrosa* (Hale) Elix & Johnston as both taxa have narrow ciliate lobes, produce cylindrical isidia, and exhibit a medullary C+ red reaction. However, *P. conlabrosa* has simple rhizines and contains lecanoric acid, while *P. minarum* has a more fragile thallus, scattered dichotomously branched rhizines and contains gyrophoric acid and 5-O-methylhiascic acid (see Hale 1976b for a full description). This pantemperate, corticolous species is apparently rare in Tasmania, although it is quite common at lower latitudes along the east coast of mainland Australia. It was recorded from the bark of *Notelaea ligustrina* in wet sclerophyll forest where it was associated with *Parmelina conlabrosa, Parmelia tenuirima, Parmelinopsis afrorevoluta* and species of *Usnea*.

SPECIMEN EXAMINED:

Tasmania — Square Mountain near Sorell, 150 m, 5 April 1981, *G. Kantvilas 228/81A* (HO).

17. **Parmelinopsis neodamaziana** (Elix & Johnston) Elix & Hale, *Mycotaxon* 29: 243 (1987). — *Parmelina neodamaziana* Elix & Johnston, *Brunonia* 9: 155 (1986).

Parmelinopsis neodamaziana is an uncommon species in Tasmania, known from a single collection from sheltered granite rocks in dry sclerophyll forest. Associated taxa included *Parmelia sulcata, Neofuscelia pulla, Xanthoparmelia mougeotina* and *Lichenothelia* aff. *solitarioides*. The species is also known from similar habitats in Queensland and New South Wales, and is characterised by delicate, linear-elongate, truncate lobes, mostly 0.5–1.5 mm wide with abundant marginal cilia, and by the lack of isidia or soredia [see Elix & Johnston (1986) for full description and illustration]. The medulla reacts C+ pale pink, and contains gyrophoric acid, 5-O-methylhiascic acid, 2,4,5-tri-O-methylhiascic acid and 2,4-di-O-methylgyrophoric acid.

Specimen Examined:

Tasmania — Sleepy Bay road, c. 1 mile west of coast, 20 m, 2 February 1984, *P. James & G. Kantvilas s.n.* (HO).

18. **Parmeliopsis ambigua** (Wulf.) Nyl., *Syn. Lich.* 2: 54 (1863). — *Lichen ambiguus* Wulf. in Lacq., *Coll. ad Botanic.* 4: 239: tab. 4, fig. 2 (1790).

Parmeliopsis ambigua is characterised by a tightly adnate, orbicular, small foliose to ± placodioid pale yellow thallus with capitate soralia and black to dark brown, rhizinate lower surface [see Thomson (1984) for detailed description and Wirth (1987) for photograph]. It contains usnic and divaricatic acids. Apothecia are not known in Tasmanian material.

This species is widespread on bark and wood in the cold to cool temperate regions of the Northern Hemisphere and has also been recorded from New South Wales. It is very rare in Tasmania where it has been collected from the dead twigs of *Orites acicularis* in alpine heathland at the margins of open montane forest of *Athrotaxis cupressoides*. Associated lichens included *Menegazzia testacea* and *Hypogymnia lugubris*.

Specimen Examined:

Tasmania — Walls of Jerusalem, foot of Halls Buttress, 1330 m, 10 December 1987, *G. Kantvilas 111/87* (HO,ANUC).

19. **Rimelia cetrata** (Ach.) Hale & Fletcher, *Bryologist* 93: 26 (1990). — *Parmelia cetrata* Ach., *Syn. Lich.* : 198 (1814).

Rimelia cetrata is characterised by a large foliose thallus, broad lobes with prominent cilia, a pale grey upper surface with a reticulum of maculae which develop into cracks in older lobes, simple to squarrose branched rhizines and prominent pedicellate apothecia with a perforate disc (see Hale & Fletcher 1990 for a full description). *R. cetrata* is widespread in temperate regions of the world being particularly common in south-eastern United States and in South Africa, especially on corticolous substrates. This species appears uncommon in Tasmania where is was recorded from sheltered granite outcrops in dry sclerophyll forest. Previous reports of this species in Australia refer to *Rimelia austrocetrata* (Elix & Johnston) Hale & Fletcher, a species which differs in developing laciniate, dissected lobes with a fragmented and exfoliating upper cortex (Elix & Johnston 1988).

Specimen Examined:

Tasmania — Freycinet Peninsula, Sleepy Bay Road, 20 m, 15 October 1980, *G. Kantvilas 478/80* (HO).

20. **Tomasellia ischnobela** (Nyl.) Keissl., *Rab. Krypt. Fl.*, Band 9, Abt.1, 2: 431 (1938). — *Melanotheca ischnobela* Nyl., *Flora* 59: 238 (1876).

Tomasellia ischnobela is an inconspicuous species, found in Tasmania on smooth, shaded bark in cool temperate rainforest. It is distinguished by the following characters:

thallus crustose, thin, scurfy to absent; ascocarps perithecioid, consisting of black, irregularly hemispherical stromata, 0.2–0.5 mm wide, with 2–4 separate chambers; pseudoparaphyses branched, anastamosing, persistent; spores filiform, multiseptate, 50–120 × 1–2 μm, 8 per ascus, arranged side by side in bundles (see also Swinscow 1965, Poelt 1969).

The species is doubtfully lichenised and is apparently closely related to *Leptorhaphis* (see also Aguirre & Hawksworth 1987). *Tomasellia ischnobela* is also known from the British Isles.

Specimens Examined:

Tasmania — Balts Spur, Tasman Peninsula, 420 m, July 1983, *G. Kantvilas 166/83* (HO); Weindorfers Forest, Waldheim, 820 m, 30 March 1988, *G. Kantvilas 57/88* (HO).

21. **Trapeliopsis flexuosa** (Fr.) Coppins & P. James, *Lichenologist* 16: 258 (1984). — *Biatora flexuosa* Fr., *Sched. crit. lich. Suec.* 2 (fasc.8): 11 (1826).

Trapeliopsis flexuosa is recognised by the following characters:

thallus pale glaucous grey, areolate-crustose to minutely subsquamulose, coarsely sorediate, C+ red and containing gyrophoric acid; soralia roundish, scattered, sometimes becoming confluent; apothecia 0.25–0.75 (–1) mm diam., disc brownish grey to greenish grey, plane to convex, proper margin pale, persistent; spores simple, 6.5–10 × 2.5–4 μm (see Coppins & James 1984 for further data).

In Tasmania, *T. flexuosa* has been recorded in wet sclerophyll forest on charred eucalypt stumps. It was associated with species typical of this habitat, including *Hypocenomyce australis*, *H. foveata*, *Cladia schizopora*, *Cladonia rigida* and *Neophyllis melacarpa*. The species is known from Europe and North America and has also been recorded from Victoria (Müller 1893) and Queensland (Hafellner *et al.* 1989).

Specimen Examined:

Tasmania — Yarlington Tier, 620 m, 30 November 1988, *G. Kantvilas 587/88* (HO,O).

22. **Xanthoparmelia exillima** (Elix) Elix & Johnston, *Bull. Br. Mus. nat. Hist. (Bot.)* 15: 245. — *Parmelia exillima* Elix, *Aust. J. Bot.* 29: 357 (1981).

Xanthoparmelia exillima is a small, subcrustose, narrow-lobed, isidiate species, known from southern Australia and New Zealand. In Tasmania, it is rare and known from a single collection from sandstone in dry sclerophyll forest. It is very similar to the very common lichen, *X. mougeotina*, but differs in having a yellow-brown to brown lower surface and containing norlobaridone (medulla P−, K−, C−, KC+ rose). For a full description and illustration, see Elix (1981) and Elix *et al.* (1986).

Specimen Examined:

Tasmania — Hunting Grounds, *c.* 4.5 km west of Dysart, 400 m, 7 October 1981, *G. Kantvilas & P. James 474/81* (HO,BM).

23. **Xanthoparmelia rubrireagens** (Gyelnik) Hale, *Phytologia* 28: 488 (1974). — *Parmelia rubrireagens* Gyelnik, *Annls. Mycol.* 36: 288 (1938).

Xanthoparmelia rubrireagens is one of several similar species with loosely adnate, linear-elongate, ± subdichotomous lobes (termed the '*subnuda*-group' by Elix *et al.* 1986). It is characterised by a black, ± wrinkled, very sparsely rhizinate lower surface and by the presence of salazinic acid (medulla P+ orange, K+ yellow red). Known also from south-eastern Australia and New Zealand, the species was recorded in Tasmania from sandstone outcrops in dry sclerophyll forest. The species was previously referred to in Australian literature as *X. eradicata*, a South African taxon, and a full description and illustration are provided by Elix *et al.* (1986) under that name.

Specimen Examined:

Tasmania — Hunting Grounds, *c.* 4.5 km west of Dysart, 400 m, 7 October 1981, *G. Kantvilas & P. James 486/81* (HO,BM).

24. **Zahlbrucknerella calcarea** (Herre) Herre, *J. Wash. Acad. Sci.* 2: 384 (1912). — *Zahlbrucknera calcarea* Herre, *Proc. Wash. Acad Sci.* 12: 129 (1910).

Zahlbrucknerella calcarea is a cosmopolitan species characterised by a minutely filamentous, blackish thallus, tiny apothecia with a distinct thalline margin and brown disc, and simple, hyaline, broadly ellipsoid to subglobose spores, 6.5–9 (–11) × 5–8 µm, up to 24 per ascus. It is very inconspicuous and forms tiny, dispersed tufts *c.* 0.5 mm tall and 0.5–1 mm wide on limestone and dolomite (see Henssen 1977, Galloway 1985 for further data). The Tasmanian collection was associated with *Placynthium nigrum* and occurred on limestone outcrops in pasture.

Specimen Examined:

Tasmania — Mole Creek, 350 m, 19 February 1984, *G. Kantvilas & P. James 366/84A* (HO,MB,BM).

ACKNOWLEDGEMENTS

We thank Dr S.J. Jarman for comments on the manuscript, Mr A. Aptroot, Dr A.W. Archer, Dr D.J. Galloway, Prof. P.M. Jørgensen, Dr E. Timdal and Prof. Dr. A. Henssen for comments on selected specimens and Prof. P.L. Nimis for locating the type specimen of *Parmelina pseudorelicina*.

REFERENCES

Aguirre, B. & Hawksworth, D.L. (1987) The circumscription, biology and relationships of the genus *Leptorhaphis* Körber. *Bibliotheca Lichenologica* 25: 249–255.

Archer, A.W. (1988) The lichen genus *Cladonia* section *Cocciferae* in Australia. *Proc. Linn. Soc. N.S.W.* 110: 205–213.

Archer, A.W. & Bartlett, J.K. (1986) New species and distribution of the lichen genus *Cladonia* in New Zealand together with a revised key. *N.Z. J. Bot.* 24: 581–587.

Arvidsson, L. & Galloway, D.J. (1981) *Degelia*, a new lichen genus in the Pannariaceae. *Lichenologist* 13: 27–50.

Coppins, B.J. (1988) Notes on the genus *Arthopyrenia* in the British Isles. *Lichenologist* 20: 305–325.

Coppins, B.J. & James, P.W. (1984) New or interesting British lichens V. *Lichenologist* 16: 241–264.

Elix, J.A. (1979) A taxonomic revision of the lichen genus *Hypogymnia* in Australasia. *Brunonia* 2: 175–245.

Elix, J.A. (1981) New species of *Parmelia* subgen. *Xanthoparmelia* (lichens) from Australia and New Zealand. *Aust. J. Bot.* 29: 349–376.

Elix, J.A. (1990) Lichenes Australasici Exsiccati, Fasc. 8, No. 183.

Elix, J.A. & Hale, M.E. (1987) *Canomaculina, Myelochroa, Parmelinella, Parmelinopsis* and *Parmotremopsis*, five new genera in the Parmeliaceae (lichenized Ascomycotina). *Mycotaxon* 29:233–244.

Elix, J.A. & Johnston, J. (1986) New species of *Parmelina* (Lichenized Ascomycotina) from Australia and New Zealand. *Brunonia* 9: 155–161.

Elix, J.A. & Johnston, J. (1988) New species in the lichen family Parmeliaceae (Ascomycotina) from the Southern Hemisphere. *Mycotaxon* 31: 491–510.
Elix, J.A., Johnston, J. and Armstrong, P.A. (1986) A revision of the lichen genus *Xanthoparmelia* in Australasia. *Bull. Br. Mus. nat. Hist. (Bot.)* 15: 163–362.
Esslinger, T.L. (1977) A chemosystematic revision of the brown *Parmeliae*. *J. Hattori Bot. Lab.* 42: 1–211.
Filson, R.B. (1982) A contribution on the genus *Parmelia* (Lichens) in southern Australia. *Aust. J. Bot.* 30: 511–582.
Galloway, D.J. (1985) 'Flora of New Zealand Lichens.' (Wellington: Government Printer.)
Galloway, D.J. & Jørgensen, P.M. (1975) *Erioderma sorediatum*, a new lichen from New Zealand. *Lichenologist* 7: 139–142.
Hafellner, J., Filson, R.B. & Rogers, R.W. 1989 Some genera and species of lichenized fungi new to Australia. *Nova Hedwigia* 48: 229–235.
Hale, M.E. (1976a) A monograph of the lichen genus *Pseudoparmelia* Lynge. *Smithsonian Contrib. Bot.* 31: 1–62.
Hale, M.E. (1976b) A monograph of the lichen genus *Parmelina* Hale (Parmeliaceae). *Smithsonian Contrib. Bot.* 33: 1–59.
Hale, M.E. & Fletcher, A. (1990) *Rimelia* Hale & Fletcher, a new lichen genus (Ascomycotina: Parmeliaceae). *Bryologist* 93: 23–29 (1990).
Hayward, G.C. (1977) Taxonomy of the lichen families Graphidaceae and Opegraphaceae in New Zealand. *N.Z. J. Bot.* 15: 565–584.
Henssen, A. (1977) The genus *Zahlbrucknerella*. *Lichenologist* 9: 17–46.
Henssen, A. & James, P.W. (1980) *Parmeliella duplomarginata*, a new lichen from New Zealand. *Mycotaxon* 11: 217–229.
Jørgensen, P. M. & James, P. W. (1990) Studies in the lichen family Pannariaceae IV. The genus *Degelia*. *Bibliotheca Lichenologica* 38: 253–276.
Kantvilas, G. (1989) A checklist of Tasmanian lichens. *Pap. Proc. R. Soc. Tasm.* 123: 67–85.
Kantvilas, G. (1990) Notes on the lichen flora of New South Wales 1. New records. *Telopea* 4: 19–31.
Müller, J. (1883) Lichenologische Beiträge XVII. *Flora* 66: 305.
Müller, J. (1893) Lichenes Wilsoniani, s. lichenes a cl. Rev. F.R.M. Wilson in Australiae Prov. Victoria lecti. *Bull. Herb. Boissier* 1: 33–65.
Poelt, J. (1969) 'Bestimmungsschlüssel Europäischer Flechten.' (Cramer: Vaduz.)
Swinscow, T.D.V. (1965) Pyrenocarpous Lichens: 9 Notes on various species. *Lichenologist* 3: 72–83.
Thomson, J.W. (1984) 'American Arctic Lichens 1. The Macrolichens.' (Columbia Univeristy Press: New York.)
White, F.J. & James, P.W. (1988) Studies on the genus *Nephroma* II. The southern temperate species. *Lichenologist* 20: 103–166.
Wirth, V. (1987) 'Die Flechten Baden-Württembergs Verbreitungsatlas.' (Verlag Eugen Ulmer: Stuttgart.)

Revised manuscript received 6 June 1991.

SOME NOMENCLATURAL CHANGES IN THE ANGIANTHINAE AND CASSINIINAE (ASTERACEAE: GNAPHALIEAE)

by

PAUL G. WILSON[1], P.S. SHORT[2] & A.E. ORCHARD[3]

ABSTRACT

Wilson, Paul G., Short, P.S. & Orchard A.E. Some nomenclatural changes in the Angianthinae and Cassiniinae (Asteraceae: Gnaphalieae). *Muelleria* 7(4): 519–524 (1992) — New combinations in *Bracteantha*, *Chrysocephalum*, *Euchiton*, and *Ozothamnus* are made. There is one new name: *Ozothamnus rodwayi* Orch. replaces *O. backhousei* J.D. Hook., *nom. illeg.* Attention is drawn to some recently published illegitimate combinations.

INTRODUCTION

Recently, Anderberg (1991a) published a most useful work on the tribe Gnaphalieae. In the subtribe Angianthinae he changed, or foreshadowed further changes to, the circumscriptions of a number of genera. We do not agree with some of the conclusions but generally believe that this publication will be a good stepping stone for future work. Indeed, two of us (PGW & PSS) are collaborating with Anderberg on a cladistic analysis of the Angianthinae. We have also independently noted that, in four of the genera recognised, i.e. *Bracteantha*, *Chrysocephalum*, *Euchiton* and *Ozothamnus*, a number of new combinations to accommodate recognised taxa were not made. We believe that one species has been incorrectly assigned to *Chrysocephalum*, and that two additional species should be included within *Ozothamnus*. Furthermore, we have found instances where incorrect new combinations have been made.

Anderberg (1991b) has corrected a mistake concerning the position of *Helichrysum baxteri*, transferring it from the '*Lawrencella*' group to *Chrysocephalum*. We feel it incumbent on us to note some other mistakes and make the required new combinations.

It should be noted that the authorship of the new combinations is deliberate; the authors should not be cited as, for example, 'Orch. ex Paul G. Wilson *et al.*' but either as 'Orch. in Paul G. Wilson *et al.*' or, in the abbreviated form, 'Orch.'.

TAXONOMY

BRACTEANTHA A. Anderb. & L. Haegi

This genus is badly in need of revision. The status and circumscription of many taxa relegated to synonymy under *Helichrysum bracteatum* (Vent.) Andrews by Bentham (1867) are yet to be satisfactorily resolved. Such problems cannot be readily clarified but we have noted that one of the names under *Bracteantha* published by Anderberg & Haegi is nomenclaturally superfluous.

Bracteantha subundulata (Schultz-Bip.) Paul G. Wilson, *comb. nov.*

BASIONYM: *Gnaphalium subundulatum* Schultz-Bip., Bot. Zeitung 3: 171 (1845), as *nom. nov.* — *Helichrysum acuminatum* DC., Prod. 6: 188 (1838), *nom. illeg., non H. acuminatum* (Link) Sweet, Hort. brit. 223 (1826); — *Bracteantha acuminata* A. Anderb. & L. Haegi, Opera Bot. 104: 105 (1991), *nom. superfl.*

[1] Western Australian Herbarium, P.O. Box 104, Como, Western Australia, Australia 6152.
[2] National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141.
[3] Tasmanian Herbarium, GPO Box 252C, Hobart, Tasmania, Australia 7001.

Bracteantha viscosa (DC.) A. Anderb. & L. Haegi, Opera Bot. 104: 105 (1991).
BASIONYM: *Helichrysum bracteatum* var. *viscosum* DC., Prod. 6: 189 (1838). TYPE: '*H. viscosum* Sieb.! pl. exs. nov. holl. n. 345.'
Helichrysum viscosum Sieber ex Sprengel, Syst. Veg. 3: 484 (1826). TYPE: 'Nov. Holl.'

The basionym of *B. viscosa* was cited incorrectly by Anderberg & Haegi as '*Helichrysum viscosum* Sieber ex De Candolle, Prodr. 6: 189. 1838.' It is almost certainly conspecific with Sprengel's name and their types may be replicates of the same Sieber collection.

Although the earliest species name was not cited as the basionym by Anderberg & Haegi we consider that their combination is legitimate. Sprengel's earlier name cannot now be transferred to *Bracteantha* since to do so would create a later homonym. Consequently *B. viscosa* (DC.) A. Anderb. & L. Haegi is the earliest available name.

CHRYSOCEPHALUM Walp.

Several additional combinations probably could be made here to accommodate species or infraspecific taxa that have been accredited to the *C. apiculatum* (Labill.) Steetz and *C. semipapposum* (Labill.) Steetz complexes. Furthermore, some older names under *Chrysocephalum* possibly should be reinstated. However, as evidenced by recent Flora treatments (e.g. Haegi 1986) it is generally accepted that it is better for all such taxa to remain in synonymy until revisionary work is carried out. On the other hand, the name *C. ambiguum* (Benth.) A. Anderb. is incorrect as its basionym *Leptorhynchos ambiguus* Benth. (1867) is antedated by *Helichrysum semicalvum* F. Muell. (1861) which is considered to be synonymous (Haegi 1986). Similarly, the name *C. adpressum* (Fitzg.) Anderb. is incorrect as *Helichrysum puteale* S. Moore is synonymous and has priority. The recently described taxon *Helichrysum ambiguum* subsp. *vinaceum* Haegi (1986) is not accommodated in *Chrysocephalum*, a situation rectified here.

Chrysocephalum puteale (S. Moore) Paul G. Wilson, *comb. nov.*
Basionym: *Helichrysum puteale* S. Moore, J. Linn. Soc. Bot. 34: 198 (1899). TYPE: 'Prope puteum 'Wangine' sive 'Siberia soak' repperi mens. Jan.' (HOLOTYPE: BM).
Helipterum adpressum W.V. Fitzg., J. West Aust. Nat. Hist. Soc. 2(1): 23 (1904); — *Chrysocephalum adpressum* (W.V. Fitzg.) A. Anderb., Opera Bot. 104: 119 (1991). TYPE: 'Broad Arrow, ... Sept., 1898.-W.V.F.' (ISOTYPE: PERTH).

Chrysocephalum semicalvum (F. Muell.) Paul G. Wilson, *comb. nov.*
BASIONYM: *Helichrysum semicalvum* F. Muell., Fragm. 2: 156 (1861); — *Leptorhynchos ambiguus* Benth. var. *semicalvus* (F. Muell.) Benth., Fl. Austral. 3: 609 (1867), *comb. illeg.* TYPE: 'In rupibus tractus Barrier Range, Beckler; in montibus McDonnell Ranges Australiae centralis, J.M. Stuart.'
Helichrysum ambiguum Turcz., Bull. Soc. Imp. Naturalistes Moscou 24(1): 195 (1851), *nom. illeg.*, *non H. ambiguum* Presl, Fl. sicul. xxix (1826), *n.v.*; — *Leptorhynchos ambiguus* Benth., Fl. Austral. 3: 609 (1867) ('*Leptorhynchus*'), *nom. nov.* based on *H. ambiguum* Turcz. (ICBN, Art. 72, Ex. 2); — *Chrysocephalum ambiguum* (Benth.) A. Anderb., Opera Bot. 104: 119 (1991), as '(Turcz.) A. Anderb.', see ICBN, Art. 33, Ex. 6. TYPE: 'Drum. III. n. 121. et IV. n. 220.'

The above synonymy is based on information received from Laurie Haegi *in litt.* and from his published treatment (Haegi 1986) of the taxon.

Chrysocephalum semicalvum (F. Muell.) Paul G. Wilson subsp. **vinaceum** (Haegi) P.S. Short, *comb. nov.*
BASIONYM: *Helichrysum ambiguum* Turcz. subsp. *vinaceum* L. Haegi, Fl. S. Aust. 3: 1535 (1986).

It is felt that *C. podolepidium* (F. Muell.) A. Anderb. should be excluded from *Chrysocephalum*. It would be better referred, along with *Helipterum saxatile* Paul G. Wilson and an undescribed species, to a new genus (Wilson, in press). Such an action will leave the genus with seven species, namely *C. apiculatum* (Labill.) Steetz, *C. baxteri* (A. Cunn. ex DC.) A. Anderb., *C. eremaeum* (Haegi) A. Anderb., *C. pterochaetum* F. Muell., *C. puteale* (S. Moore) Paul G. Wilson, *C. semicalvum* (F. Muell.) Paul G. Wilson and *C. semipapposum* (Labill.) Steetz.

EUCHITON Cass.

Euchiton fordianus (M. Gray) P.S. Short, *comb. nov.*

BASIONYM: *Gnaphalium fordianum* M. Gray, Contrib. Herb. Aust. 26: 2 (1976).

NEOTYSONIA Dalla Torre & Harms

Neotysonia phyllostegia (F. Muell.) Paul G. Wilson in J.W. Green, Census Vasc. Pl. Western Australia 2nd ed. 6 (1985).

The above combination was incorrectly referred by Anderberg to Dalla Torre & Harms. The latter authors were responsible for the generic name which was a *nomen novum* for *Tysonia* F. Muell. (1896) non Fontaine (1889) but they did not publish a new combination for the type.

OZOTHAMNUS R. Br.

One of us (AEO) has recently commenced revisions of both *Cassinia* R. Br. and *Ozothamnus* and it is possible that the circumscription of the genera currently included in the *Cassinia* group by Anderberg will be substantially altered within the next few years. However, as noted by Anderberg, the Australasian taxa currently included in *Helichrysum* cannot be retained in that genus. Although it may only prove to be an interim measure, it has therefore been decided to accept both the name and essentially the same circumscription of *Ozothamnus* as used by Anderberg.

Some species are at present poorly circumscribed and the status of several infraspecific taxa is uncertain, e.g. compare the treatments of Burbidge (1958) and Curtis (1963). If Burbidge's concepts, and not those of Curtis, are deemed better then there would be a problem, for example, with the lack of a combination under *Ozothamnus* to accommodate *Helichrysum gunnii* (J. D. Hook.) Benth. subsp. *paralium* N. Burb., and a problem with several subspecies of *H. ledifolium* (DC.) Benth. recognised by Burbidge. Curtis treats most of the infraspecific taxa recognised by Burbidge as species. This treatment is generally favoured in recent works (e.g. Buchanan *et al.* 1989), and in most cases names under *Ozothamnus* are available and listed by Anderberg. However, we believe that two more species should be included in *Ozothamnus* and have also noted a number of problems with Anderberg's list of species.

Helichrysum ramosum and *H. thomsonii* were separated from *Helichrysum* by Anderberg and tentatively listed under polyphyletic *Lawrencella*. They are better referred to *Ozothamnus*.

Ozothamnus ramosus (DC.) Paul G. Wilson, *comb. nov.*

BASIONYM: *Helichrysum ramosum* DC., Prod. 6: 181 (1838); — *Gnaphalium ramosum* (DC.) Schultz-Bip., Bot. Zeitung 3: 170 (1845), *nom. illeg.*, *non G. ramosum* Lam., Fl. franc. 2: 65 (1779). TYPE: 'ad littora Novae-Hollandiae in Regis Georgii sinu legit cl. A. Cunningham.' (HOLOTYPE: G-DC).

Helichrysum gracile DC., Prod. 6: 181 (1838); — *Gnaphalium georgii* Schultz-Bip., Bot. Zeitung 3: 170 (1845), as *nom. nov.* TYPE: 'in siccis sterilibus ad Regis Georgii sinum in Nova-Holl. legit cl. Cunningham.' (HOLOTYPE: G-DC).

Ozothamnus thomsonii (F. Muell.) Paul G. Wilson, *comb. nov.*

BASIONYM: *Helichrysum thomsonii* F. Muell., Fragm. 8: 45 (1873).

A new name is required for *O. backhousei* and new combinations are required for several infraspecific taxa which, as indicated in the synonymy below, are accepted in recent check-lists and Floras.

Ozothamnus rodwayi Orch., *nom. nov.* Based on *Cassinia cuneifolia* A. Cunn. ex DC., Prod. 6: 155 (1838). — *Ozothamnus backhousei* J. D. Hook., Fl. Tasman. 1: 204 (1856) ('*backhousii*"), *nom. illeg.*, based on above. — *Helichrysum backhousei* Benth., Fl. Austral. 3: 632 (1867) ('*backhousii*"), *non H. cuneifolium* Benth., *op. cit.* 633. — *Helichrysum cuneifolium* (A. Cunn. ex DC.) Tovey & Morris, Proc. Roy. Soc. Victoria 35: 195 (1923), *nom. illeg.* TYPE: 'ad faciem rupestreum montis Wellington in insula Van-Diemen januar. flor. legit cl. A. Cunningham.'

The epithet honours Leonard Rodway (1853–1936), dentist, naturalist, and author of *The Tasmanian Flora* (1903).

The name *Helichrysum backhousei* Benth. is legitimate and is to be treated as a *nom. nov.* since the name on which it was based is illegitimate (ICBN, Art. 72, Ex. 2). The name *Cassinia cuneifolia* DC. cannot be transferred to *Ozothamnus* since there already exists an *O. cuneifolius* (Benth.) A. Anderb.

Ozothamnus rodwayi Orch. var. **kingii** (W. M. Curtis) P.S. Short, *comb. nov.*

BASIONYM: *Helichrysum backhousei* (J.D. Hook.) F. Muell. ex Benth. var. *kingii* W.M. Curtis, *Rec. Queen Victoria Mus. (Tasmania)* 50: 3 (1974); Buchanan *et al.*, *Census Vasc. Pl. Tasmania* 6 (1989).

Ozothamnus rodwayi Orch. var. **oreophilus** (W.M. Curtis) P.S. Short, *comb. nov.*

BASIONYM: *Helichrysum backhousei* (J.D. Hook.) F. Muell. ex Benth. var. *oreophilum* W.M. Curtis, Rec. Queen Victoria Mus. (Tasmania) 50: 4 (1974); Buchanan *et al.*, Census Vasc. Pl. Tasmania 6 (1989).

Ozothamnus obcordatus DC. subsp. **major** (Benth.) P.S. Short, *comb. nov.*

BASIONYM: *Helichrysum obcordatum* (DC.) F. Muell. ex Benth. var. *majus* Benth., *Fl. Austral.* 3: 632 (1867) ('*major*'); *Helichrysum obcordatum* subsp. *majus* (Benth.) N. Burb., Aust. J. Bot. 6: 257 (1958) ('*major*'); Jacobs & Pickard, Pl. New South Wales 79 (1981).

Ozothamnus scaber F. Muell., Linnaea 25: 407 (1853).

The combination to accommodate *Helichrysum bilobum* Wakef. subsp. *scabrum* (F. Muell.) N. Burb. under *O. retusus* is also lacking. Haegi (1986), however, has already noted that the species may prove to be specifically distinct, a possibility supported by the few specimens examined at MEL. Therefore, we suggest that the name *Ozothamnus scaber* F. Muell. be adopted for this taxon.

The combinations under *Ozothamnus* for *Helichrysum bilobum* (= *O. retusus*, not *O. bilobus*), *H. catadromum* (= *O. decurrens*, not *O. catadromus*), *H. dendroideum* (= *O. ferrugineus*, not *O. dendroideus*) and *H. ericeteum* (= *O. ericifolius*, not *O. ericeteus*) that were published by Anderberg are illegitimate, being superfluous when published as earlier binomials are available. The combinations for *O. cinereus* and *O. secundiflorus* published by Anderberg are also superfluous, having been previously published, and the combination *O. rosmarinifolius* was first published by Sweet, not de Candolle.

Ozothamnus cinereus (Labill.) Sweet, Hort. brit. 221 (1826); — *Chrysocoma cinerea* Labill., Nov. Holl. Pl. 2: 39 (1806); — *O. cinereus* (Labill.) A. Anderb., Opera Bot. 104: 89 (1991)('*cinerea*'), *comb. superf.* A New Caledonian species.

Ozothamnus decurrens F. Muell., Trans. Philos. Inst. Victoria 3: 59 (1859); — *Helichrysum decurrens* (F. Muell.) F. Muell., Fragm. 8: 46 (1873), *nom. illeg., non H. decurrens* Moench, Methodus 576 (1794); — *Helichrysum catadromus* Wakef., Victorian Naturalist 68: 51 (1951), as *nom. nov.*; — *Ozothamnus catadromus* (Wakef.) A. Anderb., Opera Bot. 104: 89 (1991), *nom. illeg.*

Ozothamnus ericifolius J.D. Hook., Lond. J. Bot. 6: 119 (1847), non *Helichrysum ericifolium* Less., Syn. gen. Compos. 314 (1832); *Helichrysum pleurandroides* F. Muell., Fragm. 5: 200 (1866) as *nom. nov.*; Buchanan *et al.*, Census Vasc. Pl. Tasmania 6 (1989); — *Helichrysum ledifolium* (DC.) Benth. subsp. *ericifolium* (J.D. Hook.) N. Burb., Aust. J. Bot. 6: 272 (1958); — *Helichrysum ericeteum* W.M. Curtis, Stud. Fl. Tasman. 2: 463 (1963) as *nom. nov., nom. illeg.*; — *Ozothamnus ericeteus* (W.M. Curtis) A. Anderb., Opera Bot. 104: 89 (1991), *nom. illeg.*

Ozothamnus ferrugineus (Labill.) Sweet, Hort. brit. 221 (1826); — *Eupatorium ferrugineum* Labill., Pl. Nov. Holl. 2: 38, t. 180 (1806); — *Chrysocoma ferruginea* (Labill.) Spreng., Syst. 3: 424 (1826); — *Petalolepis ferruginea* (Labill.) Cass., Dict. Sci. Nat. 39: 195 (1826); — *Helichrysum ferrugineum* (Labill.) Less. ex Steud., Nom. Bot. 2nd ed. (1840), *nom. illeg., non H. ferrugineum* Persoon, Syn. pl. 2: 414 (1807), *nec H. ferrugineum* Less., Syn. gen. Compos. 317 (1832); — *Helichrysum dendroideum* Wakef., Victorian Naturalist 68: 50 (1951), as *nom. nov.*; — *Ozothamnus dendroideus* (Wakef.) A. Anderb., Opera Bot. 104: 89 (1991), *nom. illeg.*

Ozothamnus retusus Sond. & F. Muell., Linnaea 25: 510 (1852); — *Helichrysum retusum* (Sond. & F. Muell.) F. Muell., Fragm. 8: 46 (1873), *nom. illeg., non H. retusum* (Lam.) Spreng.(1826); — *Helichrysum bilobum* Wakef., Victorian Naturalist 68: 51 (1951), as *nom. nov.*; — *Ozothamnus bilobus* (Wakef.) A. Anderb., Opera Bot. 104: 89 (1991), *nom. illeg.*

Ozothamnus rosmarinifolius (Labill.) Sweet, Hort. brit. 221 (1826); — *Eupatorium rosmarinifolium* Labill., Nov. Holl. Pl. 2: 38, t. 181 (1806); — *Chrysocoma rosmarinifolia* (Labill.) Spreng., Syst. 3: 424 (1826); — *Petalolepis rosmarinifolia* (Labill.) Cass., Dict. Sci. Nat. 39: 195 (1826); — *Helichrysum rosmarinifolium* (Labill.) Benth., Fl. Austral. 3: 631 (1867).

Ozothamnus secundiflorus (Wakef.) C. Jeffrey in W.J. Bean, Trees & shrubs hardy in the British Isles 8th ed. 3: 75 (1976); — *Helichrysum secundiflorum* Wakef., Victorian Naturalist 68: 49 (1951); *O. secundiflorus* (Wakef.) A. Anderb., Opera Bot. 104: 89 (1991), redundant combination.

As the name *Ozothamnus* R. Br. is masculine *O. rogersianus* (J.H. Willis) A. Anderb. is the correct spelling, not *O. rogersianum* as used by Anderberg.

ACKNOWLEDGEMENTS

We thank Hansjoerg Eichler, Laurie Haegi, Charles Jeffrey, Nicholas Lander and Jim Ross for comments on various manuscripts, and in particular Arne Anderberg for constructive suggestions and some additional information.

REFERENCES

Anderberg, A.A. (1991a). Taxonomy and phylogeny of the tribe Gnaphalieae (Asteraceae). *Opera Botanica* 104: 1–195.

Anderberg, A.A. (1991b). The systematic position of *Helichrysum baxteri* A. Cunn. ex DC. — A correction. *Compositae Newsl.* 19: 22–23.

Buchanan, A.M., McGeary-Brown, A. & Orchard, A.E. (1989). *A census of the vascular plants of Tasmania.* (Tasmanian Herbarium Occasional Publn No. 2.)
Burbidge, N.T. (1958). A monographic study of *Helichrysum* subgenus *Ozothamnus* (Compositae) and of two related genera formerly included therein. *Aust. J. Bot.* 6: 229–284.
Curtis, W.M. (1963). *The Student's Flora of Tasmania.* (Govt Printer: Tasmania.) Pt 2.
Haegi, L. (1986). *Helichrysum. In* Jessop, J.P. & Toelken, H.R., *Flora of South Australia.* (Govt Printer: Adelaide.) pp. 1523–1538.

Revised manuscript received 20 June 1991

A NEW SPECIES OF *LOBELIA* L. (CAMPANULACEAE: LOBELIOIDEAE) FROM VICTORIA AND SOUTH AUSTRALIA.

by

David Albrecht*

ABSTRACT

Albrecht, D.E. A new species of *Lobelia* L. (Campanulaceae: Lobelioideae) from Victoria and South Australia. *Muelleria* 7(4): 525–528 (1992). — *Lobelia beaugleholei sp. nov.* is described and illustrated, with notes on distribution, conservation status, habitat and relationships to some other species of *Lobelia* and *Pratia.*

INTRODUCTION

The opportunity is here taken to formally describe an entity known for many years as *Pratia* sp. aff. *purpurascens* (R. Br.)Wimmer. The name *P.* sp. aff. *purpurascens* was first adopted by Willis (1973) and has been perpetuated in several subsequent publications, including Toelken (1986) and Ross (1990). Examination of a range of herbarium specimens and populations *in situ* has confirmed the distinctiveness of this taxon and somewhat surprisingly revealed that its rightful placement is in *Lobelia* rather than *Pratia.*

TAXONOMY

Lobelia beaugleholei D.E. Albrecht *sp. nov.*

Lobelia membranaceae affinis sed seminibus majoribus, capsulis latioribus, tubo corollae diviso minus profunde, superis lobis corollae latioribus, et setis terminantibus antheras infernas longioribus differt.

Holotypus: Victoria, Lower Glenelg River area, Red Gum Swamp, S of Greenwald, 17 Jan. 1965, *A.C. Beauglehole 6519* (MEL 540822).

Rhizomatous perennial *herb. Stems* decumbent, glabrous or rarely with scattered spreading hairs, rooting at nodes. Primary *roots* 0.5–1.2 mm diameter. *Leaves* alternate; blades slightly discolourous, ± tinged purplish on undersurface, the lowermost orbiculate, spathulate, oblate, ovate, obovate or elliptic, the uppermost ovate to lanceolate, 4–22 mm long, 3–20 mm wide, reducing in size along stem, glabrous or occasionally with scattered fine hairs, margins subentire, or with 2–8 widely spaced short teeth or shallow lobes on either side, each tooth or lobe with a minute transluscent region at apex, apex obtuse to acute; petiole to 15 mm long, reduced in the uppermost leaves. *Flowers* axillary, solitary, borne at irregular intervals along the stem, bisexual, protandrous. *Pedicels* (1-)3–11 cm long, glabrous or rarely with scattered hairs towards the base, usually strongly recurved at distal end in fruiting specimens. *Hypanthium* obconical, glabrous. *Calyx* lobes erect, subulate, 1.4–2.5 mm long, glabrous or rarely with marginal hairs, often with a tooth on either side towards the base. *Corolla* subbilabiate, (8-)9–12 mm long, glabrous externally; upper two lobes spreading or erect, light violet (Methuen colour code 18A5) on both surfaces, narrowly elliptic to oblanceolate, 3.5–6.5 mm long, 1–2.5 mm wide, glabrous to scabridulous on upper surface and margins, acute; lower three lobes spreading, light violet, becoming white towards the base with a prominent green ridge extending from the sinus between each lobe into the tube, oblanceolate to obovate, 4.5–8.5 mm long, 1.5–4 mm wide, glabrous to scabridulous on upper surface and margins, acute; tube split along the upper side to 1.2–2 mm from base, white to light green externally, white internally, 3.3–4.8

* National Herbarium of Victoria, Birdwood Avenue, South Yarra, Victoria, Australia 3141

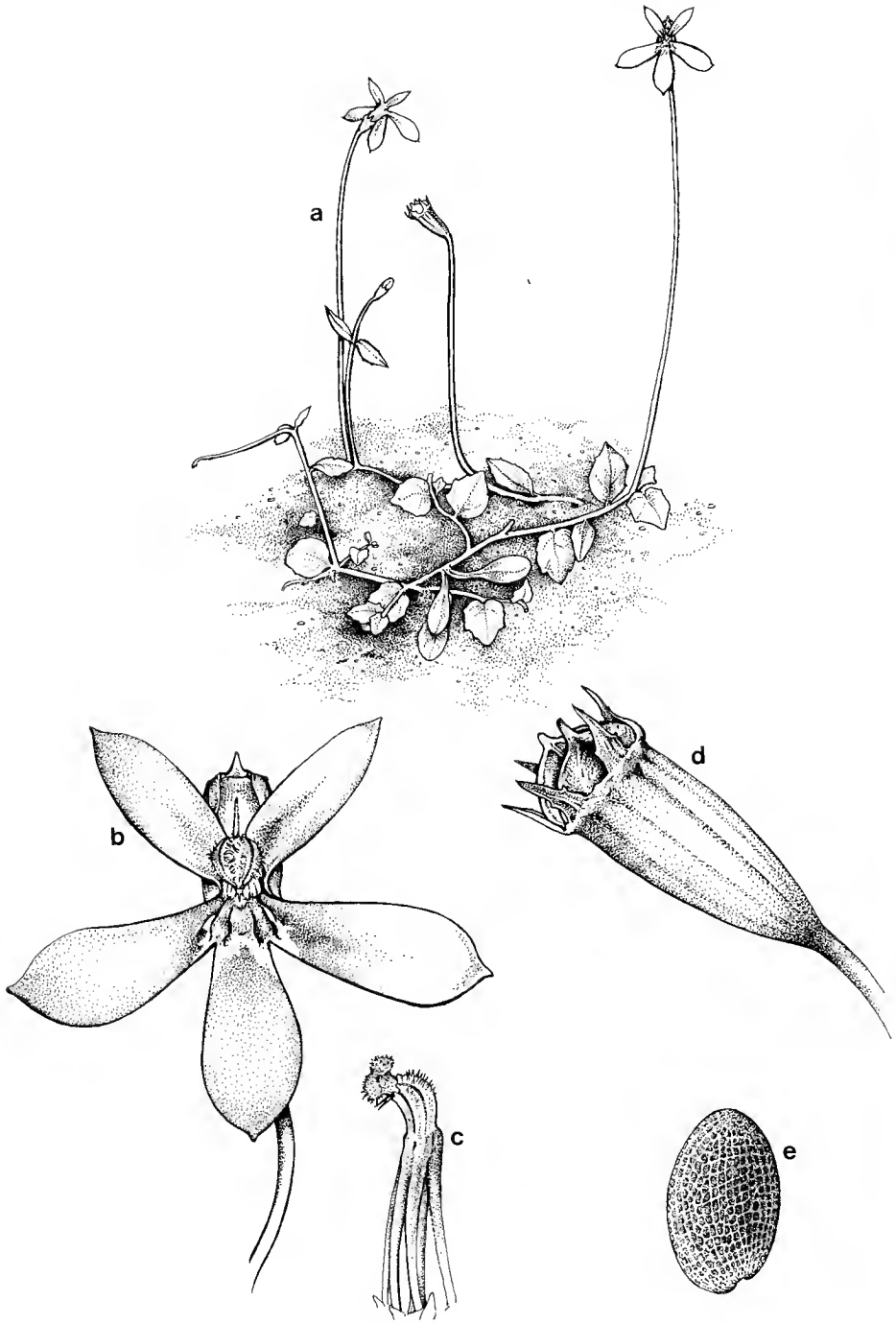


Fig. 1 *Lobelia beaugleholei*. a-habit, ×1. b-flower, ×5. c-partially fused staminal filaments, anther tube and protruding stigma, ×6. d-capsule, ×5. e-seed, ×25. a-d from *Barnett s.n.*; e from *Beaugleholе 6519*.

mm long, with fine retrorse hairs internally. *Filaments* adnate to the corolla tube, fused for *c.* 1 mm at distal end, green at base, white above and deep blue (Methuen colour code 19E8) below anther tube, 3.7–4.5 mm long, glabrous to scabridulous. *Anther tube* blue-black (Methuen colour code 19F3), 1.2–1.7 mm long, the exterior surface of the three upper anthers with few to many fine acute hairs c. 1.5 mm long, the apex of the two lower anthers each with a seta 0.3–0.6 mm long and a cluster of short thick hairs 0.1–0.2 mm long. *Stigma* protruding from apex of anther tube at maturity, 2-lobed and girt with a ring of hairs. *Capsule* obconical, slightly compressed, 5.5–10.5 mm long, 3–5.5 mm wide, glabrous, apical valves raised 1.2–2.5 mm above the base of the calyx lobes, dehiscing loculicidally. *Seeds* light brown, ellipsoid, slightly compressed, 1–1.1 mm long, 0.5–0.6 mm wide, testa minutely perforated. (Fig. 1)

ETYMOLOGY:

The specific epithet honours Mr A. Cliff Beauglehole of Portland, who recognised the distinctiveness of this taxon some 45 years ago and whose collections comprise the majority of herbarium specimens of it.

REPRESENTATIVE SPECIMENS (18 specimens examined):

Victoria — Bushland Reserve 19 km S of Colac P.O., 25 Jan. 1979, *A.C. Beauglehole* 63786 (MEL 118292); Otways, Bridge track, 38°33′25″S, 143°37′30″E, 8 Dec. 1984, *G.E.Earl s.n.* (MEL 115819); Otways, *c.* 0.75 m N of the junction of Mt McKenzie road and Hargreave track, 27 Dec. 1973, *A.C. Beauglehole 43859* (MEL 540821); Otways, Lavers Hill road, 38°40′S, 143°20′E, 7 Dec. 1985, *P.F. Barnett s.n.* (MEL 1545309); Flora and Fauna Reserve *c.* 30 km E of Warrnambool P.O., 29 Jan. 1979, *A.C. Beauglehole 63835* (MEL 118293); Carpendeit Reference Area 32 km WSW of Colac P.O., 13 Dec. 1979, *A.C. Beauglehole 67279* (MEL 118291); Portland District, Gorae West, Nov. 1946, *A.C. Beauglehole s.n.* (MEL 540828); Curdies River, Dec. 1873, *F.Mueller s.n.* (MEL); Island Swamp *c.* 4.5 km S of Greenwald, 38°01′00″S, 141°23′00″E, 15 Feb. 1991, D.E. Albrecht 4736 (MEL 224622); Unnamed swamp *c.* 0.5 km NNW of Four Corners, 38°03′15″S, 141°23′00″E, 15 Feb. 1991, *D.E. Albrecht 4739* (MEL 224621); Unnamed circular swamp *c.* 5.5 km due SE of Greenwald, 38°00′40″S, 141°25′45″E, 15 Feb. 1991, *D.E. Albrecht 4732* (MEL 224623).

South Australia — South-eastern region, Glencoe Swamp, 37°35′S, 140°30′E, 6 Mar. 1977, *R.Bates 2633* (AD 97714073).

DISTRIBUTION AND CONSERVATION STATUS:

In Victoria the species is regarded as rare (Gullan *et al.*, 1990) being known from relatively few scattered sites in the Otways and far south-west regions. Fortunately most known populations occur in biological reserves and at least some consist of numerous plants. In South Australia the species is known from only one site in the south-east and should be regarded as rare in that state.

HABITAT:

Lobelia beaugleholei occurs exclusively on black organic loam soils, in the vicinity of swamps and drainage lines at altitudes below 200 m. It has been recorded from a range of structural vegetation types typical of wetlands, including herbfield, wet scrub, woodland and fringing damp sclerophyll forest. Associated species include *Eucalyptus camaldulensis, Eucalyptus ovata, Melaleuca squarrosa, Centella cordifolia, Goodenia humilis, Gonocarpus micranthus, Juncus procerus, Lobelia pratiodes, Pratia puberula* sensu Toelken (1986) and *Pratia pedunculata sensu* Toelken (1986).

DISCUSSION:

Fruit type is the primary character used to separate *Lobelia* (with dehiscent fruits) from *Pratia* (with indehiscent fruits). As the new species has capsular fruit there seems little doubt that it should be placed in *Lobelia* rather than in *Pratia.*

Although the new species has been likened to *Pratia purpurascens* (R. Br.) F. Wimmer (also known as *Lobelia purpurascens* R. Br.in Queensland), it appears to be more closely allied to the Queensland species *Lobelia membranacea* R. Br.

Bentham (1868) tentatively referred specimens collected by Robinson from the Fitzroy River (far south-west Victoria) to *Lobelia membranacea*. I have not examined Robinson's specimens, which are housed at Kew, but it is probable that they are *Lobelia beaugleholei*. *Lobelia beaugleholei* and *Lobelia membranacea* are readily separated on seed shape and size, the former having ellipsoid seeds 1–1.1 mm long and 0.5–0.6 mm wide, the latter having more or less orbiculate seeds *c.* 0.4 mm diameter. *Lobelia beaugleholei* also difers from *Lobelia membranacea* in having broader capsules (≧ 3 mm, *cf.* ≦ 3 mm in *Lobelia membranacea*), less deeply split corolla tubes (divided to 1.2–2 mm from base, *cf.* ≦ 1 mm in *Lobelia membranacea*), broader upper corolla lobes (≧ 1 mm, *cf.* usually ≦ 1 mm in *Lobelia membranacea*) and longer setae terminating the lower anthers (≧ 3 mm, *cf.* ≦ 3 mm in *Lobelia membranacea*).

Pratia purpurascens differs from *Lobelia beaugleholei* in having more uniform, elliptic to ovate leaves that are usually strongly toothed, spreading to recurved calyx lobes, functionally unisexual flowers with white corollas that are tinged pink or purplish on the underside of the lobes and tube, narrower corolla tubes, markedly dissimilar upper and lower corolla lobes (the upper lobes less than half the width of the lower lobes), and seeds with a pitted rather than perforated testa. *Pratia purpurascens* occurs in far eastern Victoria and extends northwards along the eastern coast of Australia to southern Queensland.

Lobelia beaugleholei often grows with *Pratia puberula* Benth. (*sensu* Toelken 1986) and *Pratia pedunculata* (*sensu* Toelken 1986) and occasionally collectors have inadvertently gathered more than one taxon in a collection. *Lobelia beaugleholei* can be distinguished from both taxa by the less leafy habit, the larger lower leaves with longer petioles, the larger bisexual flowers with light violet corolla lobes, the presence of fine acute hairs on the upper surface of the anther tubes, the capsular (rather than indehiscent) fruits and the larger seeds with a perforated testa.

ACKNOWLEDGEMENTS

I am indebted to my colleague Neville Walsh for preparing the Latin diagnosis and for comments on the manuscript; to Doug Frood for assistance with fieldwork; to A. Cliff Beauglehole for providing habitat and distribution data; to Paul Barnett for providing habitat information and for procuring fresh material for illustration; to Anita Barley for preparing the illustration that accompanies the text; and to the curators of AD and BRI for the loan of specimens.

REFERENCES

Bentham, G. (1868). 'Flora Australiensis: a Description of the Plants of the Australian Territory'. Vol 4. (Reeve: London.) pp. 129–130.

Gullan, P.K., Cheal, D.C. & Walsh, N.G. (1990). 'Rare or Threatened Plants in Victoria'. (Department of Conservation and Environment: Melbourne.)

Kornerup, A. & Wanscher, J.H. (1978). 'Methuen Handbook of Colour'. 3rd edn. (Methuen: London.)

Ross, J.H. (1990). 'A Census of the Vascular Plants of Victoria'. 3rd edn. (National Herbarium of Victoria: Melbourne.)

Toelken, H.R. (1986). Campanulaceae — *Pratia*. *In* J.P.Jessop & Toelken, H.R. (eds), 'Flora of South Australia'. (South Australian Government Printing Division, Adelaide) pp. 1374–1376.

Willis, J.H. (1973). 'A Handbook to Plants in Victoria'. Vol 2 .(Melbourne University Press: Carlton.) p. 631.

Mauscript received 6 August 1991.

'SUCH INGENIOUS BIRDS': FERDINAND MUELLER AND WILLIAM SWAINSON IN VICTORIA

by

SARA MAROSKE[1] & HELEN M. COHN[2]

ABSTRACT

Maroske, Sara & Cohn, Helen M. 'Such ingenious birds': Ferdinand Mueller and William Swainson in Victoria. *Muelleria* 7(4): 529–553 (1992). — William Swainson and Ferdinand Mueller were both appointed botanists to the Victorian government by Lieutenant-Governor La Trobe, in 1852 and 1853 respectively. Swainson was a zoologist and illustrator who strongly supported the quinary system of zoological classification. He migrated to New Zealand in 1840. Ferdinand Mueller was a young, enthusiastic and relatively inexperienced German botanist who migrated to South Australia in 1847. The reports submitted by the two men to La Trobe during 1853 presented dramatically different views on the Victorian flora and its distribution and evolution. Swainson's *Botanical report*, his only botanical publication, has never been considered a worthwhile taxonomic document, while Mueller's signalled the beginning of a long and distinguished career spent studying the Australian flora.

INTRODUCTION

Ferdinand Mueller and William Swainson were appointed to botanical positions in the colony of Victoria within a few months. Swainson was accepted as a botanical draftsman on 11 September 1852 for one year, and Mueller as Government Botanist on 26 January 1853. In hindsight it is difficult to understand why Lieutenant-Governor La Trobe appointed Swainson. The short reports which he submitted in March and October 1853 seem at once remarkable for their ignorance, arrogance and inventiveness. Without the benefit of such hindsight, however, it would have been just as difficult to understand why La Trobe appointed Mueller. He was a young, unknown botanist, and a German in an English colony. Victoria's flora had been little explored prior to 1852, and the work of any contemporary botanist, however then or now regarded, carries with it all the significance of being among the 'first' in the field. This fact alone makes unravelling the story of Mueller and Swainson worthwhile. Why did La Trobe appoint them? What did they actually do? And why has Swainson been repeatedly dismissed in Australia's history of botany, whereas Mueller is revered as our foremost botanical pioneer?

'DISEASED OR PERVERTED IMAGINATIONS': SWAINSON'S LONDON CAREER

In 1840 William Swainson (Fig. 1) shook the dust of England from his feet and emigrated with family, library and entomological specimens to the other side of the world. He left behind a 25-year career as naturalist and writer and a somewhat equivocal reputation. As a skilled natural history draftsman and industrious writer he earned considerable respect. However, he displayed a regrettable propensity for engaging in heated public arguments, and in promoting his views was too single-minded for the taste of his colleagues. Swainson was deeply interested in natural history, particularly birds and insects, and shared his father's

[1] 'Correspondence of Ferdinand von Mueller' project, Department of History and Philosophy of Science, University of Melbourne, Parkville, Victoria, Australia 3052.
[2] National Herbarium of Victoria, Birdwood Ave, South Yarra, Victoria Australia 3141.

Fig. 1. William Swainson 1840 (Reproduced from *Taxidermy: with the biography of zoologists and notices of their works*. London, 1840.)

enthusiasm for collecting shells (McMillan 1980). He made the most of his opportunities while in Sicily with the army. After leaving military service in 1815, Swainson spent two years in Brasil, a country just opening up to scientific exploration (Farber 1985). The classification and publication of his Brasilian collections launched Swainson on his career and brought him within the orbit of the leading naturalists of his day.

In his wholehearted adoption of the new technique of lithography, and his skill in using it, Swainson deserves much of the credit for its favourable reception in Britain (Dance 1978). Lithography proved cheaper and quicker than engraving and, unlike copper plates, the stones could be reused (Knight 1977; Jackson 1975). From the artist's point of view, in drawing directly onto stone, the finished print was his own work; no longer was he hostage to the skill (or lack of it) of the engraver. With Swainson leading the way lithography quickly superseded engrav-

ing as the principal means of depicting natural history objects. The first such work published in Britain using lithography was Swainson's *Zoological illustrations* (1820–23), in which he brought his Brasilian collections before the public (Knight 1986b). Contemporary opinion held his artistry in high regard. His illustrations for *Birds of West Africa* (1837) were described as 'beautiful delineations' which 'owe nothing to the touch of imagination' (Anon. 1837a), while the reviewer of his *Flycatchers* (1838a) thought the printer's skill not equal to the lithographer's (Anon. 1838a).

Despite his reputation as an artist, Swainson never achieved a central position in scientific circles. This can be traced to his background and his position in the community of London naturalists; to his belligerent character; and to his unremitting reiteration of the merits of his own work and philosophical theories. Swainson was the son of a Liverpudlian customs collector, and therefore not of high social standing. As such he lacked the networks of contacts and patronage that still played a vital role in establishing a place in the circles to which Swainson aspired. This circumstance, and his lack of a university degree, counted against him in his first attempt to obtain a paid position as a naturalist in London. Swainson's activities as a collector and illustrator brought him to the fringes of London scientific circles. From there he tried to find himself a permanent and lucrative niche, and to secure a career as more than just a collector.

In 1822 he applied for the directorship of the Zoological Department of the British Museum. He had hopes of success, being now an experienced zoologist and having testimonials from men such as George Cuvier, J.E. Smith and William Hooker (Swainson 1840). However, Humphrey Davy, now President of the Royal Society, secured the position for J.G. Children of the Museum's Department of Antiquaries, a man with little zoological knowledge. The slightly clandestine manner of Children's appointment (not to mention the scandalously neglected state of the collections) caused a public outcry at least partly engineered by Swainson (Desmond 1985; Knight 1986b). There were, however, some telling arguments against Swainson's candidature; his orthography was suspect; his lack of a university education meant he was deficient in foreign languages, notably Greek and Latin. Finally and perhaps most importantly, he simply was not an establishment figure (Desmond 1985; Farber 1985; Gunther 1984). The whole experience left Swainson rather bitter.

With his path to institutional science blocked, Swainson turned to the precarious business of writing. His decision was given additional force when his father's death left him with a smaller inheritance than he expected, and failed investments left him in an even more parlous financial situation. With a growing family to support, Swainson took on a grinding workload. Until his departure from England Swainson's literary output was extraordinary. Between 1834 and 1840 Swainson wrote twelve books. Writing appeared to be virtually the only option open to him; he came to believe he was deliberately being excluded from an institutional career (Desmond 1985). Of his second unsuccessful application to the British Museum in 1837 he sourly remarked; 'I was not, however, so far honoured as to receive any notice to my application' (Swainson 1840).

This belief was reinforced by the circumstances of one of his most spectacular public squabbles. From 1830 Swainson worked with John Richardson on the publication of the bird volumes for Richardson's account of his Arctic expeditions, Swainson contributing much of the text and 50 lithographic plates (Richardson & Swainson 1831). Unfortunately many of the specimens he needed to consult had been placed with the Zoological Society. As a lapsed member he was denied access. Richardson tried to smuggle him into the Society's rooms; J.J. Audubon succeeded but they were discovered, and ignominiously removed themselves from the building (Desmond 1985). Swainson vented his spleen on the inflexible Secretary, N.A. Vigors. The two men engaged in a public slanging match, acrimony reverberating through the pages of the *Magazine of natural history* over a period of four years.

In brawling with Vigors, Swainson was in conflict with a man who in philosophical terms was his ally. Both were ardent disciples of the quinary system of zoological classification. This system was devised by William Sharpe MacLeay, an enthusiastic entomologist with impeccable connections to London scientific circles. After a sojourn in Paris, where he was close to the debate on natural zoological classification systems, MacLeay published his quinary scheme in *Horae entomologicae* (1819–21). This system was held to be natural because in its mathematical symmetry it reflected the intrinsic pattern and continuity of God's design for nature (Di Gregorio 1983).

The quinary system is notoriously difficult to understand but in simple terms it is based on circles of five, and on the principles of analogy and affinity. The animal kingdom was divided into five primary groups, each of these was further divided into five, and so on. In progressing from any given species, a series of beings was said to display natural affinities if it eventually led back to that original species, thereby creating a circle. For example, fish had affinities with amphibians via the tadpole, amphibians with reptiles through the adult frog, reptiles with birds by the flying pterodactyl, birds with mammals through the duck-billed platypus and mammals with fish via whales. Any given member of such a circular group was also held to be analogous with the animal which sat on the same place in another circular group. Thus, snakes and snails were on different circles but were analogous because both lacked legs and crawled on their bellies (Gould 1984).

Swainson took to himself the role of chief propagandist of the quinary system. He spent several years in perfecting his exposition and refining the number of circles to three. All of Swainson's books were exercises in arranging the animal kingdom into quinary format, his main essay being *A preliminary discourse on the study of natural history* (Swainson 1835b). The quinary system was a useful tool for Swainson in meeting his publication deadlines. Operating as it did on external characters, it allowed Swainson to write about whole groups of animals of which he had only the most superficial knowledge. He seems to have been unaware of (or ignored) much recent zoological research. As a result his fish were 'disastrous' (Günther 1900), the *Thylacine* was classified with the dogs, and his study of shells did not look at their inhabitants; conchology not malacology.

The zoological community was sharply divided about quinary theory. According to one's standpoint, either 'little less than wilful blindness is the barrier opposed to its admission as the only true basis of natural systematic arrangement', or the quinary system was only to be found 'in the diseased or perverted imaginations of those who uphold it' (Anon. 1837a). The debate soon spilled onto the pages of scientific journals. MacLeay's editors saw fit to apologise for his intemperate language in replying to a rival systematist (MacLeay 1830; Di Gregorio 1983). Swainson berated as unknowledgeable and malicious the critic of his *Preliminary discourse* (Swainson 1835a). Such was Swainson's reaction to any adverse comment that one reviewer nastily referred to 'Mr Swainson's no less convenient than ingenious belief, that limited zoological knowledge is the barrier to comprehension of the natural system with those who, like ourselves, have never come forward as converts to the principles embodied in his views on zoological classification' (Anon. 1838c).

In the face of all this controversy it is easy to overlook the fact that quinary theory was treated seriously as a zoological classification system during the 1820s and early 1830s. The rancour exhibited in skirmishes between its champions and detractors should not be taken to indicate that the quinary system was dismissed as ridiculous or unscientific. There was in fact a bewildering range of systems being proposed and vigorously debated (Di Gregorio 1983), and Swainson was by no means the only writer to base his work on this system. However, it was essentially a zoological system, barely disturbing the botanical community which was far more advanced towards general acceptance of one natural classification scheme. John Lindley was dismissive, remarking that he saw 'no necessity or propriety in combating a system which as far as Botany is concerned can scarcely be said to have an existence' (Knight 1986a).

Swainson's London career left him a disappointed and bitter man (Parkinson 1985; Knight 1986b). His living was precarious and he had not risen to the heights he would have liked. After his failure at the British Museum he held aloof from all institutional zoology, thereby cutting himself off from a forum for discussion that could have informed his theories (Knight 1986a). Swainson found it increasingly difficult to be conversant with all the subjects he was writing about. Mistakes were apparent in some of his later books, while theoretical commitment to the quinary system reduced the usefulness of others (Knight 1977; Farber 1985). With his fractious and ungenerous behaviour he alienated many of his colleagues. He was reproved for his assumption of superior knowledge and for his *'spirit of detraction*, or at least an unwillingness to do full justice to the merits of others' (Anon. 1837b, 1838b).

By 1840 Swainson had decided to leave England. He recognised that he would never be other than on the fringes of zoological circles. Unremitting authorship had worn him down and he was constantly frustrated by criticisms of his work (Swainson 1838b). The death of his wife in 1835 left him feeling England was no place to raise his children (Swainson 1840). His choice of destination was the infant settlement of New Zealand, attracted by the promises of the New Zealand Company. At over 50 years of age and with young children for whom to provide, this would seem a courageous move. In leaving England, Swainson was cutting himself off from the world he knew, and committing himself to a life for which the sedentary career of a writer had not prepared him; carving a farm out of virgin forest and making it viable. The Swainson family arrived in New Zealand in 1841 among the earliest settlers under a Wakefieldian emigration scheme of dubious legality (Pretty 1967; Dalziel 1981).

Swainson went to New Zealand hopeful of being able to pursue his natural history interests and even act as mentor to the other settlers (Swainson 1840). Sadly his hopes were dashed. Establishing the farm left little time spare for any other avocations. In common with many others, Swainson's farm did not flourish. Local Maoris, disputing the settlers' title to the land, subjected them to constant harassment which eventually flared into the Hutt War (Galloway 1978). True to form, Swainson became embroiled in arguments with the New Zealand Company, from whom he had bought his land (Natusch & Swainson 1987). In 1848 he suffered a severe blow when a disastrous fire destroyed house, farm buildings and implements, six-months provisions, and natural history collections (Parkinson 1985). He was reduced to reliance on his army half-pay.

What time Swainson could spare was devoted mainly to shell collecting. Although his projected New Zealand conchology never eventuated, he did publish a fern exsiccatum (Parkinson 1985; Natusch & Swainson 1987). In general, however, he found naturalists lacking and the flora disappointing; 'there is not a flower equal to our common foxglove, not so pretty as the ground ivy or dead nettle!' (Galloway 1978). Even in New Zealand he maintained his scientific isolation. On being elected to the infant New Zealand Society Swainson took umbrage. His efforts to share his experience and knowledge having been treated with ridicule and disparagement, he refused to lend his name to the delusion 'that science is just as much honoured and cultivated in New Zealand as in the mother country' (Parkinson 1985).

Swainson must have seen the possibility of visiting Australia as a welcome relief from pressing domestic problems. The sale of land he owned in South Australia (the origin of which is unclear), now risen in value, would alleviate his financial worries. He also had acquaintances in New South Wales from whom he could expect a welcome. Foremost was William Sharpe MacLeay, now well-established at the centre of Sydney society and colonial natural history circles. As a fellow quinarian, Swainson might well have expected to receive some notice from MacLeay but his correspondence is strangely silent about him. Swainson sailed for New South Wales aboard *Acheron* in May 1851 at the invitation of her captain, J.L. Stokes, with whom Swainson had sailed in 1849 collecting shells around the New Zealand coast. Once in New South Wales, Swainson spent most of his time in

the Illawarra district awaiting the papers related to the sale of his South Australian land (Natusch & Swainson 1987). Here he happily occupied himself investigating the local eucalypts (Swainson to Deas Thomson, 30 July 1852).

Swainson's career was drawing to an end when he arrived in Australia, while Mueller's was only just beginning. It was, however, the northern hemisphere experiences of both men that determined what qualifications they had to offer employers in the south. Both men received their scientific training without the advantages of wealth and connections. Nevertheless, while Swainson's pursuit of his science was colourful and controversial, Mueller's was a lesson in orthodoxy.

'TO DEVOTE MYSELF TO THE NATURAL SCIENCES': MUELLER'S BACKGROUND

When his father died in 1835 the ten-year-old Mueller's prospects must have looked bleak. His mother moved the family from Rostock, where her husband had worked as a customs controller, to live among relatives in Tönning. In 1840 tuberculosis struck the family a second time, leaving Mueller an orphan. Before dying, however, Louise Mueller managed to apprentice her son to a pharmacist in Husum, A.G. Becker. It was possibly through the influence of this man that Mueller became interested in botany, and determined to devote himself to its study. Later in life Mueller recalled to R.J.D. von Fischer-Benzon that the Scandinavian geologist, J.G. Forchhammer, had also received his first education in natural history in Becker's house. In 1842 Becker died and the pharmacy went to his nephew E.G. Becker. 'I want to acknowledge,' Mueller told Fischer-Benzon in 1887, 'that [this nephew] cared for the orphaned boy with almost fatherly affection' (Mueller to Fischer-Benzon, 16 Dec. 1887).

By 1845 Mueller's circumstances were secure enough for him to enrol at the University of Kiel; 'partly to pass the pharmaceutical state examination', he recalled to Fischer-Benzon, 'and particularly to devote myself to the natural sciences' (Mueller to Fischer-Benzon, 16 Dec. 1887). He submitted a thesis on a local plant, *Capsella bursa-pastoris*, and graduated with a doctorate in philosophy in 1847. By this time he had also prepared manuscripts on the flora of Husum, and of Schleswig-Holstein (Mueller 1847). He was 21 years old.

Meanwhile Mueller's oldest sister, Iwanne, had succumbed to tuberculosis. Believing that he also would not survive the next winter he decided to emigrate with his two remaining sisters, Bertha and Clara. The destination they chose was South Australia, as Mueller later recalled; 'where the stream of German emigrants mainly flowed'. It was also little-known botanically, and thus offered a rich field for original research. '[M]y botanical excursions into the open fields', Mueller recalled to Fischer-Benzon, 'had already then aroused the fervent wish, to explore independently in other parts of the world.' Mueller had also read F.H.A. von Humboldt's *Voyage aux région equinoxiales de nouveau continent*, and it further stimulated his desire to travel (Mueller to Fischer-Benzon, 16 Dec. 1887).

Mueller's ship-board possessions probably included Robert Brown's *Prodromus florae novae hollandiae*, volume one of J.G.C. Lehmann's *Plantae preissianae*, and the first volumes of A.P. de Candolle's *Prodromus systematis naturalis regni vegetabilis*. At that time these were the most significant works on or including Australian plants, which were arranged in a natural system. Botany was revolutionised in the eighteenth century when Linnaeus established binomial nomenclature, and a system of classification based on stamens and pistils. Nevertheless, Linnaeus himself called this system artificial, believing that it was not for any man, however talented, to impose his ideas on the limitation and affinity of species. The plant kingdom was conceived of and created by God on the third day. A 'natural' system of classification, therefore, would be one based on His plan, painstakingly revealed by the study of multiple characters, and the grouping of species which were related by their simultaneous creation, and divine logic (Morton 1981).

The idea of a natural system was soon accepted in European botany. In 1789 A.L. de Jussieu published his *Genera plantarum* which not only used Linnaean nomenclature but also extended the work of this famous botanist on affinities in species and genera to higher levels in the taxonomic hierarchy. It was the work of the de Candolles, however, that was to become the basis of the *International code of botanical nomenclature* in the late nineteenth century. A.P. de Candolle saw the first of his eight volumes of his *Prodromus* published in 1818, and his son, Alphonse, brought the number up to twenty by 1873. The work was intended to describe and arrange all known plants, and succeeded in covering 80,000 species, but did not extend beyond the dicotyledons.

Mueller's set of de Candolle's *Prodromus* survives in the National Herbarium of Victoria Library. Volume one bears the inscription — 'Ferd. Mueller / botany student / Kiel 1846'. 'I hasten to assure you', he wrote in reply to a letter from Alphonse de Candolle in 1858, 'that the manifestations of kindness and satisfaction from so great a man as the author of the prodromus have been a source of great pleasure to myself'. The same letter also revealed that Mueller had been so bold as to offer a contribution to the *Prodromus*, supplementing the work of the German botanist C.F. Meisner on the Proteaceae family (Mueller to A.L.P.P. de Candolle, 9 Jan. 1858). Meisner's work appeared in volume 14 of the *Prodromus*, which was published in 1856. An 'Addenda et corrigenda' for the volume was brought out sometime after November 1857, and it does contain additions attributed to Mueller, including a description of *Grevillea alphonsiana* (Mueller 1857).

British botanists were slow to accept the natural system, and critical of early works using it. Robert Brown was so disappointed with the reception of his *Prodromus* in 1810 that he withdrew it from sale, and decided against bringing out a second volume (Stearn 1962). Furthermore, *Plantae preissianae* was disregarded because of the inferior scholarship of one contributor, E.T. Steudel (Diels 1906; Stearn 1939).

Mueller did not share these prejudices. There are three copies of Brown's *Prodromus* at the National Herbarium of Victoria Library out of an original print run of only 250. One of these copies was a gift to Mueller from the German botanist, O.W. Sonder. In an undated inscription Sonder wrote 'a most rare book!'. Inside are handwritten annotations by another German botanist and former owner of the book, Curt Sprengel. There is also a copy of *Plantae preissianae* at the National Herbarium Library which Mueller annotated copiously from the time he arrived in Adelaide. This work, once again, may have been a gift from Sonder, because there is an inscription at the front of the book in his handwriting 'I demand instruction, truth and knowledge'.

Mueller wasted no time in studying Australia's flora, collecting his first specimens over the side of the *Hermann von Beckerath* before it came into harbour at Adelaide. Two of these, *Sargassum distichum* and *Sargassum spinuligerum*, survive in the National Herbarium of Victoria, with the locality 'floating fragment from the ocean gulf of St Vincent', and the date 15 December 1847 (Womersley & Sinkora 1987). Mueller's paid work in Adelaide was as a pharmacist in Rundle Street, but he spent his spare time botanising. At first he explored the immediate vicinity of his new home, and then made forays further afield to Guichen Bay, the Mt Lofty Range, the Murray scrub and the Flinders Ranges. Two papers resulted from this early research on South Australian plants; 'Notes on South Australian botany' in the *South Australian register* and 'Der Murrayscrub, botanisch skizzirt' in *Hamburger Garten — und Blumenzeitung* (Mueller 1850, 1852). In 1852 he decided to move to Victoria to open a pharmacy on the goldfields. For Mueller the lure of new botanical territory must have been just as strong as the desire for financial gain.

Despite the early death of his parents, Mueller had been able to qualify as a pharmacist with a university education. A.G. Becker fostered Mueller's interest in botany and Mueller's extended family did nothing to oppose it. 'I would almost

like to shout to you: follow your own heart and inclination', wrote Mueller's uncle J.F. Mertens in January 1847. 'You alone! will know best what is most useful to you now' (Mertens to Mueller, 21 Jan. 1847). Mueller claimed to Fischer-Benzon that he received 'two for a young man splendid offers' in Schleswig-Holstein, but that he declined them in favour of Australia. '[L]ife with its hopes lay still largely before me', he exclaimed, 'when I began to explore with youthful enthusiasm the wonders of the plant world as far as they presented themselves to me' (Mueller to Fischer-Benzon, 16 Dec. 1887).

'SUCH INGENIOUS BIRDS': LA TROBE AND THE APPOINTMENTS OF SWAINSON AND MUELLER

Mueller's arrival in Victoria was opportune. This colony was singularly fortunate in having as Lieutenant-Governor, Charles La Trobe (Fig. 2), whom Mueller referred to as 'our scientific Governor' (Mueller to William Hooker, 3 Feb. 1853). From the time of separation from New South Wales in 1851, government was carried out by the governor with his executive council and a legislative council, some members being nominated by the governor and others elected

Fig. 2. Charles La Trobe *c.*1854 (Reproduced from *Lithographic portraits of early pioneers*, by permission of the La Trobe Collection, State Library of Victoria.)

according to a tightly restricted property franchise. La Trobe was able to exercise considerable control over the colony's government both directly through the executive council and indirectly through his choice of nominees for the legislative council. Victoria's expanding wealth as a consequence of the gold rush combined with La Trobe's own interests, and he was in the happy position of being able directly to influence the appointment of the first scientific officers to Victoria's civil service.

La Trobe's broad interest in natural history did not find initially much nourishment in Victoria, where there were as yet few scientists or amateur naturalists. News of gold discoveries sparked an early attempt to establish a geological society but this quickly foundered (Paszkowski 1967). Frederick Adamson and J.G. Robertson are among the small number of amateur botanical collectors of whom anything is known. Robertson came to Victoria in 1840 from Tasmania to take up farming in the Western District near Casterton. Adamson, on the other hand, did his collecting around Melbourne. Both men returned to England in the early 1850s, taking their collections with them to lodge at Kew (Maiden 1908; Rupp 1941). A more colourful character was Daniel Bunce, who had accompanied Leichhardt as botanical collector in 1846 and unsuccessfully applied for the curatorship of the Melbourne Botanic Gardens in 1849. By the early 1850s he was a columnist for the *Argus* while residing on the goldfields (Holden 1966; Fox 1989). With little time spare from his official duties, and starved as he was for scientific contacts in Australia, La Trobe was always pleased to find a fellow enthusiast. He wrote to the Tasmanian amateur botanist Ronald Gunn in October 1852; 'You judge rightly that I have not much time for natural history — however my interest in it is unabated & I am always glad to get hold of any one who knows anything about it & is observant. Such "ingenious Birds" are very rare here however' (La Trobe to Gunn, 8 Oct. 1852). In 1852, two of these rare birds came his way.

The first was William Swainson. From the relative peace and security of Illawarra, Swainson offered his services to the Victorian government as botanical draftsman in July, outlining an ambitious project to investigate the native flora (Swainson to Deas Thomson, 30 July 1852). Hedging his bets, Swainson made the same offer to the New South Wales government. For the sum of £450 and the provision of two horses and a manservant, he proposed to spend twelve months examining the timber trees of the colony, collecting specimens and making drawings. Initially it seems odd that a zoologist should offer his services as a botanist. However, his offer noted the potential use of the local trees as a source of timber which he may have seen as a possible investment for himself. As well, he was already engaged in a study of the trees around Illawarra and saw an opportunity to be paid for doing so. In particular, his attention was to be directed to the eucalypts, the classification of which was in a mess (he believed) having so far defeated the attempts of botanists to bring it into order. Here was the Swainson of old, dismissing out of hand the work of scientists far better acquainted with the subject than himself.

On receiving Swainson's letter, La Trobe wasted no time bringing it before the Executive Council, urging 'that the proposition might be highly useful to science, and to the development of the resources of the Colony, and that the necessary expense might well be [borne] from the abundant Territorial revenue' (Executive Council minutes, 23 Aug. 1852). The Council concurred with La Trobe, notification being sent to Swainson that the Victorian government was willing to engage him at the salary of £350 plus allowances. New South Wales having declined his services, Swainson accepted the Victorian offer, thereby becoming the first person employed in a botanical capacity by the Victorian government. He designated 11 September 1852 as his starting date.

It is difficult to know why La Trobe was so anxious to engage Swainson. He was not a botanist and had published no botanical papers. (It has been questioned whether the paper on Tasmanian trees published by the Royal Society of Tas-

mania in 1851 was written by our William Swainson or his namesake, who became New Zealand's first Attorney General (Jackson 1975).) Swainson claimed acquaintance with La Trobe even before he left England (Galloway 1978; Swainson to Deas Thomson, 30 July 1852), but La Trobe gives no indication of acknowledging such an acquaintance. Most likely, he was only too pleased to take up an offer so much in keeping with his personal interests, and one which allowed him easily to institute some scientific investigation under official sanction at a time when administering a colony struck with gold fever took all his time. The burgeoning colonial revenues removed any problem of remuneration.

If he were looking for a botanist to survey systematically the local flora La Trobe might well have looked to Frederick Adamson, J.G. Robertson or John Dallachy, Superintendent of the Botanic Gardens. Bunce was another possibility having published in 1851 a small booklet which purported to list the known flora of Victoria (Bunce 1851). Gunn assessed the work as a fraud; not only was it cribbed from an 1835 list of Tasmanian plants published in Hobart, but it omitted many of the plants known from around Melbourne and Geelong and included others known only in Tasmania (Pescott 1950). Since La Trobe was in frequent correspondence with Gunn it is likely he was aware of Gunn's opinion, and so would not have looked in Bunce's direction.

There is no indication, however, that La Trobe had considered a systematic botanical survey until the idea was planted by Swainson's appointment, and by the urgent necessity of appointing a mineral surveyor. The discovery of gold had rather overwhelmed La Trobe and his government. Mass immigration and the dramatic spread of settlement brought enormous problems for the civil authorities. Somewhat late in the day, La Trobe asked the Colonial Office to find him a qualified geologist, thinking that a properly conducted mineral survey of Victoria might help to control the gold fever. Alfred Selwyn was already on his way to Victoria in August 1852 when Swainson's proposal was being considered. It was in these circumstances that La Trobe's second rare bird, Ferdinand Mueller, became known to him.

It has long been believed that William Hooker was responsible for Mueller's appointment as Government Botanist but this is untenable (Cohn 1989). Responsibility rests squarely with La Trobe. His correspondence with Gunn (so far largely unutilised) is illuminating. 'There is an honest looking German here', La Trobe wrote to Gunn in October 1852, 'who as far as I can judge seems to be more of a botanist than any man I have hitherto met with in the Colony' (La Trobe to Gunn, 8 Oct. 1852). Since the same letter informed Gunn of Swainson's engagement, Mueller must have greatly impressed La Trobe. His own European background enabled him to appreciate the talents of the Europeans he met. Mueller furnished La Trobe with a description of Meisner's genus *Latrobea*, noting that two of its species, *L. brunonis* and *L. genistoides* were formerly attached to *Pultenaea*. 'He tells me', La Trobe continued, 'that an exceedingly pretty dwarf acacia flowering most abundantly in its native soil at Jolimont has been distinguished by my name also'. It seems, therefore, that Mueller made what can only be described as a calculated approach to La Trobe. 'I shall give him every encouragement', concluded La Trobe.

The official letter notifying Mueller of his appointment as Government Botanist does not reveal much about the position. It simply states that he was to receive £400 a year from 26 January 1853 (Lonsdale to Mueller, 26 Jan. 1853). If La Trobe gave any written instructions to him they have either not survived or not yet been discovered. However, as no other scientific officer's instructions are known to exist is it possible that Mueller was not given any. In his letters to La Trobe via the Colonial Secretaries, William Lonsdale and John Foster, Mueller constantly refers to 'my flora of this colony' and 'my collections' on which he was working 'according to His Excellency's commands'. From the first, Mueller's own plans were much more ambitious. In a letter dated 7 July 1853 to Ronald Gunn he suggested a plant exchange with a view to obtaining 'those which I would be

delighted to receive for the increase of the material for my "*Flora Australiae universa*"' (Mueller to Gunn, 7 July 1853). Since 1839 he had also been collecting dried specimens for a herbarium representative of the world's flora. Later in life he recalled to the New Zealand botanist T.F. Cheeseman; 'I always sought a special pride by enriching it with original specimens of author's' (Mueller to Cheeseman, 8 Aug. 1895).

'Government Botanist' was Mueller's official title but it was also one occasionally used by government clerks to describe Swainson. Moreover, in the 1852 Legislative Council papers are printed copies of letters between Swainson and the Victorian authorities under the heading 'Copy of correspondence respecting the appointment of William Swainson, Esq. as Government Botanist' (Anon. 1852). Who then was Victoria's first Government Botanist — Mueller or Swainson? In his letter of invitation to La Trobe in August 1852 Swainson referred to himself as a 'botanical draftsman', and does not thereafter use the term 'Government Botanist' relative to himself. Later he described himself as 'botanical artist and demonstrator' (Swainson to Lonsdale, 16 Apr. 1853). La Trobe was also quite clear as to titles. In March 1853 when confronted with yet another file relating to Swainson marked 'Government Botanist', La Trobe crossed out the offending words and wrote "why is it persisted in calling him [this?]" (La Trobe, March 1853 annotation on VPRS 1189, unit 203, B53/2548). No written answer by the clerk was vouchsafed. While Swainson was Victoria's first government-employed botanist, Mueller was clearly the colony's first Government Botanist.

'A GRUMBLER OF THE FIRST WATER': SWAINSON'S AUSTRALIAN FIELD WORK

By the time Swainson reached Sydney he was 62 years old and in poor health. The bitterness engendered by the downturn of his career in England had been followed by great hardship and privation in New Zealand. He must have viewed the prospect of some time at leisure pursuing natural history with some relief. Having received notification from Victoria of that government's willingness to employ him, he decided to finish what he already had in hand before starting work. It was only from the middle of September 1852 that he considered himself on the payroll. His intention was to travel overland to Victoria collecting along the way (Swainson to La Trobe, 7 March 1853). From Illawarra, he went to Parramatta and then turned south, reaching Goulburn at the end of October. Here he was struck down during a local epidemic and was laid up for six weeks. Even so he managed to discover 42 new species of gum trees. On medical advice, Swainson returned to Sydney but was not able to secure a steamer berth for Melbourne until mid-January. Four months of his 12-months engagement had expired before he arrived in Victoria.

Once in Victoria Swainson settled himself in Dandenong (Fig 3). Immediately he found cause for complaint. The residence allocated to him was an 'unfinished slab hut' which urgently needed weather-proofing. He had no drying paper or other equipment necessary to do the work. 'I have collected on foot, as far as my present ill health has permitted: but having nearly lost my life by being benighted in the Dandenong forests, I must be excused from making such excursions for the future' (Swainson to La Trobe, 7 March 1853). He soon removed himself from his unsatisfactory cottage and found lodgings some way out of Dandenong. From here he seems hardly to have stirred; 'so little of the country has been visited by me in consequence of being left without funds to defray the enormous expenses of travelling, and from being in no position to make further advances, from my own resources, on account of the local government' (Swainson to Lonsdale, 16 April 1853). Even the single assistant provided from the Botanic Gardens staff was insufficient.

Many of his complaints centred around payment of his salary and allowances and the provisions he expected to receive. There was one particularly acrimonious

Fig. 3. Ragged bark Eucalyptus, Dandenong swamps. Drawing by William Swainson. (Reproduced by permission of the Alexander Turnbull Library, Wellington, New Zealand.)

dispute about the supply of potatoes which Swainson claimed he did not receive (Childers to Foster, 13 Aug. 1853). Swainson, who prided himself on having been in the commissariat in the army, was taken to task for his sloppy accounts. 'You must not take offence at my remarking that, from first to last, if you have met with difficulty in your transaction of business with this government it is solely to be attributed to want of attention to the most ordinary forms and rules, as will be shown whenever you may come to Melbourne and proceed to adjust your accounts' (La Trobe to Swainson, 6 July 1853). Since it is doubtful that Swainson was given precise instructions on how he was to proceed, La Trobe's exasperation got the better of him in this instance.

Much of Swainson's venom was reserved for Mueller. While he was allocated an inadequate building, 'the Government caused a new and very comfortable room to be erected, at one of the buildings at the Botanic Gardens for the *additional* accommodation of the relations of the Colonial botanist' (Swainson to Legislative Council, 17 March 1854). He pointed to the higher salary enjoyed by

Mueller. 'It appears to me repugnant to justice or equity, that a young Gentleman, who has just entered the walks of Science, (more as a Collector, than a Demonstrator of Botany) should have his services more heavily remunerated than one, who, having laboured in Science for *half a century* is now about to terminate his career' (Swainson to Foster, 6 Oct. 1853).

La Trobe became very tired of the stream of complaints coming from Dandenong. He wrote to Gunn; 'all I can say is that with all his undeniable talent I have found him a very hard bargain — as helpless as a child, & a grumbler of the first water' (La Trobe to Gunn, 30 June 1853). He even doubted whether, given Swainson's evident poor health, anything would be accomplished by his visit to Victoria (La Trobe, 14 March 1853). During the eight months Swainson spent in Victoria he ventured no further than the immediate surroundings of Dandenong.

'CARELESS OF EASE': MUELLER'S EARLY FIELD WORK IN VICTORIA

A very different picture is presented by Mueller. In the first year of his appointment he embarked on two substantial field trips. The first took him on a circuit through the eastern half of the colony, starting in the Alps, heading south through Gippsland and back to Melbourne via Wilson's Promontory. In the second he circled the western half of the colony, from the Grampians north to the Murray River then back to Melbourne through the Alps. 'This exploring line', he explained to La Trobe, '[will] enable me to accumulate to a certain degree the materials for the Flora of this province' (Mueller to Foster, 22 Oct. 1853).

Mueller expected that much of Victoria's flora would be the same as that already known to exist in adjacent colonies, with the northern regions being similar to New South Wales, the west to South Australia, and the south to Tasmania. Furthermore, he knew from the books that he had brought with him to Australia that many of the species which were unique to Victoria had already been discovered by this colony's previous botanical visitors. Robert Brown had explored some of the coastal areas in Port Phillip Bay in 1802 and 1803–4. Adamson, Robertson, Bunce and La Trobe had all collected around the settlements, and in 1835–6 Thomas Mitchell had traversed the state from north to south, including the Grampians. 'I feel perfectly convinced,' Mueller therefore concluded, 'that the more distant localities in the East and North of Gipps land must be considered as the richest and most deserving country for a full phytological exploration' (Mueller to Lonsdale, 10 May 1853).

Gillbank (1992) has provided a detailed discussion of Mueller's 1853–4 excursions. From this it is clear that he did not penetrate as far into the Alps as he had hoped to do, because of unseasonal rain. Moreover, he at times mistook his location because local magnetism distorted his compass readings. Nevertheless, these trips did demonstrate in Mueller a capacity for physical endurance, and a pioneering spirit. 'My clever little botanist has returned', La Trobe told Gunn in June 1853, 'having done quite as much as I expected and more than any but a German, drunk with the love of his Science, — and careless of ease — and regardless of difficulty in whatever form it might present itself could have effected in the time and under the circumstances' (La Trobe to Gunn, 30 June 1853).

The experiences which Mueller and Swainson had in their field work determined to what extent they were able to fulfil their original aims. In the light of Swainson's complaints and Mueller's successes it is perhaps surprising to find that, while Mueller produced two substantial reports, Swainson still felt able to make many bold generalisations.

'WITH THESE FACTS BEFORE US': SWAINSON'S REPORTS

The impression given by Swainson is that, before his work, nothing of any account had been written on the eucalypts. 'It is well known', he told La Trobe in 1852, 'that . . . the "Gum trees" remain a *chaos* even after the labour bestowed upon their elucidation by such eminent men as Robert Brown, the two Cunning-

hams, and the most distinguished botanists of Europe'. Only one scientist was allowed to have said anything relevant on the subject, fellow quinarian, W.S. MacLeay. And even this man, who was the 'first authority perhaps on such questions in existence' could do no more than lament the lack of information on the subject (Swainson to Deas Thomson, 30 July 1852).

Swainson asserted that not more than 40 species of eucalypts had been published as inhabiting the whole of Australia. *Index kewensis*, however, lists 164 species of eucalypts as having been discovered up to and including 1852, 108 of which were still regarded as valid (Jackson 1885). If Swainson had consulted only de Candolle's *Prodromus* (vol. 3, 1828) he would have found 52 species listed. Lehmann's *Plantae preissianae* contained 15 species, most of which were not in de Candolle. The only volume of Brown's *Prodromus*, however, did not treat the eucalypts.

In his progress report of March 1853 Swainson revealed what he believed to be the principle of eucalypt variation. '[E]very change in the geological formation of Australia over the whole of the continent,' he asserted, 'is accompanied by a marked difference not merely in the *species*, but [also] in the *Genera* of the Eucalyptus family' (Swainson to La Trobe, 7 March 1853). Illawarra yielded him 70 species of eucalypts; the sandstone formations at Parramatta 40 species; Goulburn, with its granitic formations, 42 species; the elevated sandstone of the Blue Mountains 'many' species, and Dandenong in Victoria 55 species so far. 'Each is peculiar in its own geological formations', Swainson declared, 'and not a single species of Eucalyptus has been found by me in any *two* of these localities'.

Swainson's final eucalypt total for Victoria was a massive 1520 species, which must have taxed even his powers of invention when it came to naming them. 'I am therefore disposed to think', Swainson concluded, 'that even if two thirds may hereafter prove varieties only, there will yet remain more than *500 species botanically* distinct, only two or three of which I have found in New South Wales' (Swainson to La Trobe, 2 Oct. 1853).

Mueller was not impressed by these figures. He said of his own tally of the Victorian flora that it could easily have been doubled, 'but through a long continued examination of the Australian plants in a living state I had the advantage of learning how great [is] the uncertainty of many characteristics, which are deemed even by our greatest authorities in science sufficient for distinction' (Mueller 1853). It is true that Swainson's field experience in Victoria was considerably less than that of Mueller, but combined with what he had done in New South Wales it was certainly enough to observe eucalypt variation.

There is little indication in Swainson's Australian writings of his ideas on systematic botany. He used an hierarchical organisation when referring to the eucalypts, but treated them as a family rather than a genus (Swainson to La Trobe, 2 Oct. 1853). In letters to Gunn he suggested that capsules furnished the main characters for the limitation of his eucalypt species. Moreover, he asserted that these capsules had to be examined in a living state, because they entirely altered their appearance when dry. He did not believe that any specific characters were provided by leaves (Swainson to Gunn, 13 & 25 Feb. 1854). In a letter to William Hooker of July 1854 Mueller said that he had tried to tell Swainson that the laws of distinction in entomology could not be used on plants, 'which are a complex of individuals fixed to a soil of not always equal composition and situation and climate' (Mueller to Hooker, 14 July 1854). None of Swainson's letters or his reports, however, mention affinities, analogies or any other distinctive terms of quinary theory. Swainson may have treated as species what Mueller treated as varieties but such disagreements were possible within the de Candollean natural system.

The minor part of Swainson's final report was concerned with the practical consequences of his work. 'I have now materials, also for asserting', he informed La Trobe, 'that in very many instances [eucalypts] are [disposed] in *veins above* the earth, as regularly and as definitely, as veins of earths or metals are [disposed] *beneath* the surface'. In the gold-obsessed society of Victoria the significance of

this statement was not lost on Swainson. 'With these facts before us,' he asserted, 'we are justified in concluding the whole of Australia will exhibit the same, and that consequently a time will come when the Auriferous districts hitherto undiscovered, will be at once made known by the particular genera of *Eucalypti* that I doubt not, will be found upon their surface' (Swainson to La Trobe, 2 Oct. 1853).

In making these claims Swainson was suggesting an immediately practical application for the study of botany to the colony. George Neumayer used much the same argument about the merits of his proposed magnetic survey when trying to interest the government in supporting his work. The discovery of gold was undoubtedly the major preoccupation of the colonists at that time. The surveys undertaken by Mueller's geological counterpart, Alfred Selwyn, were directed largely towards mapping the distribution of gold in Victoria. Even Mueller made some notes on the locations of quartz veins in his early reports (Mueller to Lonsdale, 9 March 1853). Regardless of how the idea of 'golden eucalypts' may seem today, any suggestions of easy ways to locate gold were likely to be given a respectful hearing in Victoria in the 1850s.

Despite complaining about not having the resources to complete his work on eucalypts, Swainson found himself able to comment on the casuarinas as well. 'During the last year,' he informed La Trobe, 'I have made various attempts and experiments to discover the[ir] principles of variation' (Swainson to La Trobe, 2 Oct. 1853). Swainson called them the 'true pines' of Australia and, along with the genus *Exocarpus*, 'the most extraordinary groups of Trees yet discovered'. 'It was only in June last, however,', he told La Trobe, 'that this discovery was effected, and the conviction then arrived at, that all the descriptions now existing, were perfectly and essentially defective, and therefore *quite useless*'.

Mueller complained of this 'offensive statement' to William Hooker in a letter of July 1854; 'Not even my laying before him Walpers extracts of Miquel's splendid monographia of the Casuarina, of the existence of which he was unaware, could induce him to [change his mind]' (Mueller to Hooker, 14 July 1854; Walpers 1848–1849; Miquel 1848). Swainson's final report contained the names of 'more than *Two hundred* species, all still growing within a very short distance of this place'. *Index kewensis* lists 31 species published by Miquel of which it regarded 10 as still valid (Jackson 1885). The total number of casuarinas for Australia which it listed as having been published by 1852 was 65, only 23 of which it still regarded as valid.

Swainson claimed that the 'Australian pines' belonged to a primeval flora that was slowly but surely being replaced by 'a more recent order of vegetables'. He wrote, 'In this respect they offer a wonderful analogy to what we have ourselves witnessed in regard to the aboriginal tribes of Australia, now giving place to those of the Caucasian Race'. Swainson determined more than 200 species of these 'aborigines of the vegetable world', all growing within a short distance of his base in Dandenong. He could not give a precise figure, because some specimens were too decayed. 'They have, in fact, died from excessive age', declared Swainson, 'and have left no successors' (Swainson to La Trobe, 2 Oct. 1853).

Darwin's *On the origin of the species by means of natural selection* was still five years from publication when Swainson made these remarks. There were earlier scientists such as Lamarck and Chambers who also propounded evolutionary theories (Oldroyd 1980) but it is not known if Swainson was familiar with their work. Moreover, the brevity of Swainson's remarks about casuarinas makes it difficult to determine what he was suggesting at all. His analogy between aborigines and caucasians suggests a belief in the 'succession' of species (where one species is replaced or displaced by another) rather than their evolution. Nevertheless, his reference to 'recent' orders of vegetables implies that he did not believe that God created all species on the third day.

In making even cursory speculations about changes in species, however, Swainson allied himself with a theoretical movement which was gaining in

respectability. Mueller on the other hand was opposed to what he called 'transmutation theory' and remained so all his life. In 1864 he used the publication of *The vegetation of the Chatham Islands* to declare his belief in the constancy of species; 'be it understood, nature only created species, occasionally but not permanently obliterated in their characters by hybridism' (Mueller 1864).

'FORTUNATE ENOUGH TO OBSERVE': MUELLER'S BOTANICAL FINDINGS

In stark contrast to Swainson, Mueller meticulously contextualised his work in that of other botanists. The books which he brought to Australia enabled him to start his first expedition in 1853 with already about 750 species in his census of Victorian plants. By the end of the trip this number had swollen to about 1100, 'and comprise, I think nearly half the here indigenous vegetation' (Mueller 1853). In his second expedition he added another 726 plants to the census making a total of about 1700 species, 680 genera and 134 natural orders (Mueller 1854). Many of these additions were plants which had already been described in other colonies. He inserted his own discoveries in the census without any special distinction.

Swainson was happy to make good this deficiency. With some satisfaction he told La Trobe that he had found 55 new species of eucalypts within a few miles of his cottage at Dandenong; 'a greater number, in fact, than Dr Mueller (as he told me) had succeeded in discovering in *all* the parts of southern Australia, and Victoria, that he has yet visited' (Swainson to Campbell, 28 June 1853). Moreover, Swainson was even so bold as to examine the plants in Mueller's own backyard, the government domain and botanic garden, 'because the Colonial Botanist has not the knowledge . . . of undertaking this desirable object'. This work yielded him another 39 new species (Swainson to Campbell, 28 June 1853; Swainson to La Trobe, 2 Oct. 1853).

Like Swainson, Mueller believed plant distribution was influenced by geography. 'I was fortunate enough to observe' Mueller wrote during his second expedition that many of the plants which Allan Cunningham collected in Illawarra were also to be found towards the mouth of the Snowy River and along the Brodribb and Cabbage Tree Rivers. Mueller explained this coincidence by reference to the proximity of the coast and sheltered terrain (Mueller to Foster, 10 March 1854). But was this observation also a subtle criticism of Swainson's work? Swainson claimed to have discovered 70 species of eucalypts in Illawarra. But, as Mueller noted, Cunningham had already named most of this region's plants long ago. Swainson also did not find any of Illawarra's eucalypts in Victoria. In fact, unlike Mueller, Swainson never seemed to find any two areas that were geographically and botanically alike.

Mueller concluded that at 7:2 the proportion of dicotyledons to monocotyledons in Victoria was similar to all other colonies except Western Australia and subtropical South Australia (Mueller 1853). After his second expedition he refined this generalisation somewhat by noting that the north-western desert areas of Victoria yielded a proportion of 9:2 which was similar to Western Australia and subtropical South Australia (Mueller 1854). Mueller also concluded that cryptogams were twice as numerous in Victoria as in South and Western Australia because of the first colony's greater humidity. Finally, at the level of family representation he initially found that Leguminosae dominated in Victoria, as in Western Australia, but later discovered Compositae to have the greatest number of species in Victoria, as in South Australia and most countries of the world (Mueller 1853).

More than twice the number of species that Mueller found in Victoria are now known to exist (including many naturalised plants). Moreover, there have been changes to the limitation of species, and to their arrangement in genera and families. Nevertheless at about 6:2 the proportion of dicotyledons to monocotyledons is still comparable with Mueller's figure. Compositae is also still held to be rep-

resented by the largest number of species in the state, followed by Leguminosae (Ross 1976). Finally, Mueller's observations on plant localities remain uniquely valuable if only for their information on how the indigenous flora was distributed in the state before the large scale clearing and agricultural use of the land that has taken place in the last 150 years.

Mueller and Swainson's reports were also both concerned with the practical uses of Victoria's flora. Swainson speculated about metals but Mueller spoke mainly of new drugs. He told La Trobe that it was an 'inestimable truth' that the medical properties of plants could be safely deduced from their natural alliances. Thus he suggested that Victoria's *Polygala veronicea*, like Austria's *Polygala amara*, could be used to treat consumption, and that *Tasmanica aromatica*, like a similar tree in Tierra del Fuego, could be used in cases of rheumatism and intermittent fever (Mueller 1853). The principle of plant affinity which Mueller derived from his belief in the natural system is still used in the search for new drugs. Nevertheless, the particular suggestions which Mueller made in 1853 and 1854 still await evaluation.

In his second report Mueller listed 13 indigenous species which he recommended variously for use in shipbuilding, furniture and ornamental work. The provision of information on Victoria's timber trees had originally been Swainson's main brief but in his reports he had little to say on the subject. He did suggest the red gum and stringy bark might have some uses in sawing or splitting, and that the native box could be used for fencing, but excused himself from further comments. '[T]he Colonial Botanist has had the requisite facilities placed at his disposal', La Trobe was told, 'he will doubtless have succeeded far better than myself in developing the *economical* properties of the Victoria timber trees' (Swainson to La Trobe, 2 Oct. 1853). Mueller particularly drew attention to *Eucalyptus globulus* in his second report which, although common in southern forest districts, was apparently not known to Swainson. 'Experiments in Van Diemen's Land', Mueller told La Trobe, 'have shown . . . [this wood] is equal in durability to oak and superior to it in size' (Mueller 1854).

'A SERIES OF TRASH AND NONSENSE': THE CRITICS AT WORK

It is fair to say that both Mueller and Swainson's reports lived up to La Trobe's expectations. He had written to Gunn in June 1853 in a tone of resignation, 'I am prepared to see [Swainson's] statement of his labours in Victoria most plentifully interlarded with complaints of hardships & want of cordial cooperation. But *n'importe*' (La Trobe to Gunn, 30 June 1853). Such was not the case with Mueller. Again, La Trobe expressed his opinion to Gunn. 'I send you the first copy at my disposal of Dr Muellers report upon our Vegetation. It is one you will read with interest — & admit does him great credit — I consider myself very fortunate to have secured to the Colony a man of class and talent & perseverence' (La Trobe to Gunn, 27 Oct. 1853). In transmitting these (and Selwyn's) reports to the Colonial Office in London, La Trobe stated of Mueller's that 'there can be no doubt of its value and of the interest which it will excite', and further that Mueller's abilities both in the collection and examination of the flora were 'beyond all question'. Of Swainson's report he was carefully noncommittal, declaring he would leave the assessment of its scientific or economic importance to 'more competent judges' (La Trobe to Colonial Secretary, 24 Nov. 1853).

Swainson believed that his discoveries would 'be regarded with as much surprise and incredulity, among the Botanists of Europe as that of gold in Australia among the Geologists of Britain' (Swainson to La Trobe, 2 Oct. 1853). He was right. William Hooker described Swainson's report as 'brief' and 'startling', and thundered in disbelief that all the work had been done without reference to a single book (Hooker 1854). 'In all my life I think I never read such a series of trash and nonsense. There is a man who left this country with the character of a first rate naturalist (tho' with many eccentricities) and of a very first rate natural history

artist, and he goes to Australia and takes up the subject of botany of which he is as ignorant as a goose' (William Hooker to Mueller, 9 Apr. 1854).

Local opinion in Melbourne was a little more polite. William Adamson in writing to William Hooker remarked that the report was 'meagre' and he personally could find only three species of gum and two casuarinas around Melbourne (Adamson to William Hooker, 21 Jan. 1854). From New Zealand came more adverse comment. William Colenso, amateur botanist from the north island, told his friend Joseph Hooker 'I should not be too ready to believe his statements of his having discovered "many hund. sp." etc, etc, for from what I have heard of him, I believe he is superlatively fond of sounding for his own fame: & that he knows next to nothing of N. Z. Boty' (Natusch & Swainson 1987). Still later came Joseph Maiden's celebrated denunciation of Swainson's 'reckless species-making . . . unparalleled in the annals of botanical literature' (Maiden 1902).

By the time Swainson submitted his reports to La Trobe in 1853 quinary theory (and many other classification schemes) had fallen into disrepute in England, and in botany the de Candollean system had been accepted. Mueller's work was thus uncontroversial in its classifications. It is not clear whether Swainson used quinary theory in his reports, but he had attracted such opprobrium in England as the theory's chief propagandist that anything he wrote was likely to be given a sceptical reception rather than a considered appraisal. Swainson had certainly offended other scientists by his high-handed dismissal of their research. Most subsequent criticism of Swainson's reports has been of his multiplication of species. None of the other ideas he floated has received any comment. The fact that as a zoologist he was presuming to write a technical botanical paper also attracted little comment. Swainson's Australian writings were assessed as containing nothing of taxonomic significance and have never been referred to in subsequent papers on eucalypts or casuarinas (Galloway 1978). Mueller's reports, however, were quickly accepted and remain part of the canon of botanical literature.

'MUCH GOOD MAY HE DO YOU': THE END OF SWAINSON'S CAREER

Swainson left Victoria for Tasmania in October 1853, pleased to see the end of what he termed 'that hateful place' (Swainson to Gunn, 25 Feb. 1854). His departure was equally welcome in other quarters. Some months earlier, when Swainson's term of appointment was little more than half expired, La Trobe was moved to comment, 'I have signified my willingness not to stand in his way & to set him at liberty to take advantage of the more lucrative situation offered him in V.D. Land . . . I have long ago [despaired] of any satisfactory result of his visit to this Colony' (La Trobe, 30 June 1853). As Swainson's complaints continued La Trobe became more exasperated. When Swainson finally left, La Trobe wrote to Gunn, 'You have now old Mr Swainson with you — much good may he do you' (La Trobe to Gunn, 27 Oct. 1853). Even as far away as London, William Hooker noted that it was 'a matter of congratulation . . . that the terms of Mr Swainson's engagement with the colony has expired' (William Hooker to Colonial Secretary, 6 March 1854).

Barely two months after he arrived in Victoria Swainson was looking forward to the end of his engagement (Clarke to Swainson, 18 March 1853). The result was his employment by the Tasmanian government to collect specimens and seeds for four months at the rate of £50 per month, but without the provision of lodgings or rations. When this expired he occupied himself with the arrangement of the shell collections belonging to the Hobart museum. Typically he found it in a mess (Swainson to Gunn, 14 Nov. 1853). Conchology at this time occupied much of his attention. He made an extended field trip to Port Arthur to collect shells and spent much time in the company of Joseph Milligan (Swainson to Gunn, 14 Nov. 1853, 22 March 1854). He was inspired by his experiences to propose writing a con-

chology of Tasmania. However, this renewed interest in shells did not take all his time. While at Port Arthur he continued to find new species of eucalypts, '5 or 6 distinct species of my new Genus Denisonia or Blue Gums' (Swainson to Gunn, 13 Feb. 1854). (This was probably *Eucalyptus globulus* which he had apparently overlooked in Victoria.) He also started a study of *Leptospermum* having 'found they were just as imperfectly described as the Casuarinae (and from the same cause)' (Swainson to Gunn, 13 Feb. 1854). This gave him another opportunity to dismiss the work of previous (and contemporary) botanists, including Joseph Hooker (Swainson to Gunn, 25 Feb. 1854).

Despite his intention to publish further on his Victorian researches, and his continued botanical activities in Tasmania, no further botanical papers came from Swainson's pen. His last scientific contributions, published by the Royal Society of Tasmania, comprised only four papers; three on shells and the fourth on the preparation of dried skins. He attended several meetings of the Society (of which he was a member) where he could not resist the opportunity to take a swipe at Mueller. The proceedings reported him as saying 'there exists a wide and marked difference between the trees of Tasmania and those of Victoria, notwithstanding the positive assertions to the contrary published in the recent report of the Victorian Colonial Botanist' (Anon. 1855). Swainson continued to conduct a war of words with Melbourne about the settlement of his accounts and the payment of wages to his assistant (Fowler to Foster, 2 June 1854, 20 Sept. 1854). He found Tasmania an uncongenial place, complaining of the cold weather (even though it was summer) and finding the country and its productions greatly disappointing. He determined to return to New Zealand as soon as possible; 'no consideration whatever will induce me to remain a single day in these colonies longer than is necessary' (Natusch & Swainson 1987).

Swainson returned to New Zealand in June 1854, much to the relief of his family. During all the time he had been in Australia they struggled to keep the farm afloat. However, Swainson was now 65 years old and in poor health, and did not live to enjoy a fruitful old age. He died in December 1855. His son considered his father's decision to emigrate to have been his 'greatest mistake' and the family's life in the antipodes 'a succession of disappointments and misfortunes from beginning to end' (Parkinson 1985).

Nothing remains at the National Herbarium of Victoria of the drawings and collections Swainson made for the Victorian government. These were the things for which he was most likely to be respected by later botanists. He complained that his drawing paper and specimens were being ruined because of the unsatisfactory state of his Dandenong lodgings (Swainson to Lonsdale, 7 March 1853). Having indicated his wish to terminate his engagement in Victoria, Swainson was informed that, to facilitate his departure, his collections should be handed to the Superintendent of the Botanic Gardens, John Dallachy, as soon as convenient (Lonsdale to Ginn, 17 May 1853). Mueller believed the drawings to be of little practical use because of incompleteness. The few specimens Mueller saw were greatly ruined from having been packed before being dried properly (Mueller to William Hooker, 14 July 1854).

Swainson's unhappy visit to Australia marked the low point and the end of his career. By contrast, Mueller still had most of his to run. He was yet to publish a flora of Victoria, yet to try for the flora of Australia, yet to make his mark in systematic botany. Thus far he had won acclamation from his peers, and the expectation that he would continue to do so.

'OBSERVATIONS ONLY FRAGMENTARY': THE REST OF MUELLER'S CAREER

In 1854 William Hooker wrote of Mueller to Victoria's Colonial Secretary, 'he has the materials before him of an excellent and useful "Flora of the Colony of Victoria"'. Hooker requested that the governor and his executive council sanction its publication. In an annotation on Hooker's letter the Governor, Charles

Hotham, wrote, 'at present it is impossible to accede — but if the next financial year finds the Colony in a better state Sir W. Hooker's desire will be entertained' (Hooker to Foster, 2 Nov. 1854). The gold that had initially increased government revenue had by now made a chaos of Victoria's economy. Moreover, the scientifically-minded La Trobe was gone. It was to be five years before Mueller published *The plants indigenous to the colony of Victoria*. In his dedication to volume one he thanked La Trobe 'to whom, as former Lieutenant-Governor of Victoria, this work owes its origin'; William Hooker, 'the Nestor of Botanists'; and Governor Henry Barkly, 'under whose encouragement these volumes are advancing to completion' (Mueller 1860–2).

At the same time as Mueller finished Victoria's flora the question of who would write that of Australia was being discussed at Kew. Joseph Hooker wanted George Bentham to do the work. In a letter to Mueller (Fig. 4) of May 1861 he emphasized the knowledge, skill and experience required for such a massive undertaking; 'all this I *assure* you requires work of a very different character from what you have been accustomed to and a head for systematic methodology that you have never felt called upon to exercise' (Joseph Hooker to Mueller, 24 May 1861). Mueller may have impressed La Trobe and Barkly in Australia, and even William Hooker, but his authority and reputation were definitely not sufficient to persuade Joseph Hooker and Bentham to grant his much cherished wish to write the flora. Bentham took great pains to rationalize the slight to Mueller, saying in the preface to the first volume of *Flora australiensis* that Mueller's inability to visit European herbaria was the only stumbling block (Bentham 1863).

Fig. 4. Ferdinand Mueller 1861 (Reproduced from *Curtis's botanical magazine dedications 1827–1927*. London, 1931.)

Mueller never published an Australian flora or even a supplement to that of Bentham. He did, however, bring out two systematic censuses in which he 'availed himself of the opportunity, to place on record independently his views on preferable systematic sequences of orders' (Mueller 1882). Mueller's own researches had also led him to redraw the limits of some genera and many species. 'But the system, built up by [de Candolle and Jussieu]', he was careful to add, 'is in its main features so genuinously natural, that no subsequent research could bring about very material changes'. Mueller dedicated his first systematic census of Australian plants to George Bentham, Joseph Hooker and Alphonse de Candolle, 'all three sons of great men'. In so doing he emphasized that his own work was more allied to the previous generation of theorists. He may also not have minded if readers were prompted to observe that his reputation owed nothing to a famous father.

Finally, while Swainson may have had the first word in his argument with Mueller about eucalypts (Fig. 5), Mueller definitely had the last. In 1879 he published the first part of *Eucalyptographia*. It was a work which he had in contemplation since his arrival in Australia. 'Mr Swainson has been engaged in [eucalypt] examination for years', Mueller told William Hooker in 1853, 'but our views with regard to the limits of the species diverge so wi[dely] that we could not cooperate, as I otherwise would have sincerely desired' (Mueller to Hooker, 18 Oct. 1853). Like Swainson's 1853 report, *Eucalyptographia* contended 'that of all generic groups of Australian plants that of Eucalypts is the most difficult for elaboration'.

Fig. 5. *Eucalyptus robusta* (?). Drawing by William Swainson. (Reproduced by permission of the Alexander Turnbull Library, Wellington, New Zealand.)

Mueller also noted that several species differed only in regard to the persistence or secession of their bark according to 'geologic influences'. Unlike Swainson, however, Mueller did not claim to have all the answers. '[T]he subject is so large and surrounded by so many perplexities,' he declared in *Eucalyptographia*, 'that even now [the author] can offer his observations only fragmentary'. The total number of eucalypts in *Eucalyptographia* was 100. In Mueller's *Second systematic census of Australian plants* (1889) it was 134. Both totals were less than the more than 200 in *Index kewensis* (Jackson 1885), and considerably less than the 700-odd species recognized today. And all of these totals fell well short of Swainson's 1520 species.

CONCLUSION

Swainson arrived in Australia as a zoologist of considerable knowledge and experience but one who always seemed to be at odds with the establishment. Mueller on the other hand was a young and enthusiastic botanist, but also unknown and untried. Lieutenant-Governor La Trobe was responsible for each of their appointments to the Victorian public service. He was interested in science, had considerable influence over the colony's substantial revenues and few opportunities to catch 'such ingenious birds'. That seems to be why he unquestioningly allowed Swainson to take up a botanical project, and also why he made another botanical appointment within such a short time. Nevertheless, the continued dismissal of Swainson's work and the acclamation given to Mueller's have almost made it seem that La Trobe did appoint only one botanist. There can be no doubt that Swainson's main offences were his extreme species-making and dismissal of other scientists' work. Other and subsequently more tenable speculations in his *Botanical report* (1853) have gone unnoticed. Mueller in his reports was careful to locate his work within an established framework, and not to claim too much credit for himself. His conclusions were uncontroversial. Later in his career he had struggles for authority, and also lived to see younger men pursue ideas he could not accept. However, he has remained within a tradition that is still theoretically acceptable.

ACKNOWLEDGEMENTS

Particular thanks are due to Doris Sinkora who translated some difficult German and Latin texts and provided general comments. Other comments were received from Linden Gillbank, Rod Home, Ian O. Maroske, Lawrence Cohn, Tim Sherratt, Doug McCann, and David Albrecht. Sheila Natusch, Arthur Lucas and Andrew May provided some additional references. The Alexander Turnbull Library, Wellington, New Zealand kindly gave permission to reproduce the illustrations by Swainson. Permission to reproduce the portrait of Charles La Trobe was granted by the La Trobe Collection, State Library of Victoria.

REFERENCES

Abbreviations

CO Colonial Office, London. Inwards correspondence to the Secretary of State from Victoria: Series 309/19, Despatches; Series 311/2, Sessional papers.

Kew Archives, Royal Botanic Gardens, Kew, England. Director's letters vol. 74, Australian letters 1851–1858.

ML Mitchell Library, State Library of New South Wales, Sydney, Australia.

NHV Archives, Royal Botanic Gardens and National Herbarium of Victoria, South Yarra, Australia.

VPRS Public Record Office, Laverton, Victoria, Australia. VPRS 1189, inwards registered correspondence, VA 856 Colonial Secretary's Office; VPRS 3219, outwards registered correspondence, VA 856 Colonial Secretary's Office; VPRS 3991, inwards registered correspondence, VA 856 Colonial Secretary's Office.

Unpublished Sources

Adamson to William Hooker, 21 Jan. 1854. Kew letterbooks v.74 f.2.
Childers to Foster, 13 Aug. 1853. VPRS 1189, unit 203, D53/8034.
Clarke to Swainson, 18 March 1853. VPRS 1189, unit 203, B53/5320.
Executive Council minutes, 23 Aug. 1852, CO 311/2.
Fowler to Foster, 2 June 1854. VPRS 1189, unit 203, F54/5520.
Fowler to Foster, 20 Sept. 1854. VPRS 1189, unit 203, G54/10429.
Joseph Hooker to Mueller, 24 July 1861. NHV M3.
William Hooker to Colonial Secretary, 6 March 1854. CO 309/29, f.323–324.
William Hooker to Foster, 2 Nov. 1854. VPRS 1189, unit 203, M55/796.
William Hooker to Mueller, 9 Apr. 1854. NHV M2.
La Trobe, 14 March 1853. Minute on VPRS 1189, unit 203, A53/2548.
La Trobe, 30 June 1853. Minute on VPRS 1189, unit 203, 53/6444.
La Trobe to Colonial Secretary, 24 Nov. 1853. CO 309/19.
La Trobe to Gunn, 8 Oct. 1852. ML A249.
La Trobe to Gunn, 30 June 1853. ML A249.
La Trobe to Gunn, 27 Oct. 1853. ML A249.
La Trobe to Swainson, 6 July 1853. VPRS 1189, unit 203, D53/6611.
Lonsdale to Ginn, 17 May 1853. VPRS 3219, unit 20, 53/5601.
Lonsdale to Mueller, 26 Jan. 1853. VPRS 3219, unit 20, 53/446.
Mertens to Mueller, 21 Jan. 1847. NHV M100.
Mueller, F. (1847). *Botanische Skizze der Sudwestlichsten Gegenden Schleswigs.* (Unpublished notebook in National Herbarium of Victoria.)
Mueller to A.L.P.P. de Candolle, 9 Jan. 1858. Archives du Conservatoire botanique de Genève, Geneva, Switzerland.
Mueller to Cheeseman, 8 Aug. 1895. Auckland Institute and Museum.
Mueller to Rudolph von Fischer-Benzon, 16 Dec. 1887. MS: C666, Landesbibliothek, Kiel, Germany.
Mueller to Foster, 22 Oct. 1853. VPRS 1189, unit 203, D53/8374.
Mueller to Foster, 10 March 1854. VPRS 1189, unit 203, E54/3047.
Mueller to Gunn, 7 July 1853. ML A251.
Mueller to William Hooker, 3 Feb. 1853. Kew v.74 f.135
Mueller to William Hooker, 14 July 1854. Kew v.74 f.141.
Mueller to Lonsdale, 9 March 1853. VPRS 3991, unit 408, A53/2892.
Mueller to Lonsdale, 10 May 1853. VPRS 3991, unit 408, A53/4902.
Swainson to Campbell, 28 June 1853. VPRS 1189, unit 203, 53/6444.
Swainson to Deas Thomson, 30 July 1852, enclosed with covering letter of the same date, Swainson to Lonsdale. VPRS 1189, unit 203, B52/3134.
Swainson to Foster, 6 October 1853. VPRS 1189, unit 203, C53/10140.
Swainson to Gunn, 14 Nov. 1853. ML A247.
Swainson to Gunn, 13 Feb. 1854. ML A247.
Swainson to Gunn, 25 Feb. 1854. ML A247.
Swainson to Gunn, 22 March 1854. ML A247.
Swainson to La Trobe, 7 March 1853. VPRS 1189, unit 203, 53/2542.
Swainson to La Trobe, 2 Oct. 1853. VPRS 1189, unit 203, C53/10139. This report was published as '*Botanical report of William Swainson, Esq., F.R.S.*' (Swainson 1853).
Swainson to Legislative Council, 17 March 1854. VPRS 1189, unit 203, F54/1369.
Swainson to Lonsdale, 7 March 1853. VPRS 1189, unit 203, A53/2539.
Swainson to Lonsdale, 16 Apr. 1853. VPRS 1189, unit 203, B53/4061.

Published Sources

Anonymous (1837a). [Review of] Naturalists library. Ornithology. Vol.VII. Birds of West Africa. W. Swainson. *Mag. Nat. Hist.* ns, 1:324–330.
Anonymous (1837b). Reviews and critical analysis. Dr Lardner's Cabinet cyclopaedia. Natural history. 1. On the geography and classification of animals, by W. Swainson (. . .). *Mag. Zool. Bot.* 1:545–566
Anonymous (1838a). [Review of] Jardine's naturalist's library. Ornithology. Muscicapidae or flycatchers. W. Swainson. *Mag. Nat. Hist.* ns, 2:389–390.
Anonymous (1838b). Reviews and critical analysis (. . .). The elements of modern conchology (. . .). *Mag. Zool. Bot.* 2:238–265.
Anonymous (1838c). [Editorial reply to Swainson's 'A short reply to my reviewers'.] *Mag. Nat. Hist.* ns, 2:498–501.
Anonymous (1852). Copy of correspondence respecting the appointment of William Swainson, Esq., as Government Botanist. *In* Victoria. Parliamentary Papers. Votes and proceedings of the Legislative Council 1852.
Anonymous (1855). Proceedings [for 1854]. *Pap. & proc. Roy. Soc. Tasmania* 3:164.
Bentham, G. (1863). *Flora australiensis: a description of the plants of the Australian territory. Volume 1.* (Lovell Reeve: London.)
Brown, R. (1810). *Prodromus florae novae hollandiae (. . .).* (Johnson: London.)
Bunce, D. (1851). *Hortus victoriensis: a catalogue of the most generally known flora of the colony of Victoria (. . .).* (Harrison: Melbourne.)

de Candolle, A.P. (1824–1873). *Prodromus systematis naturalis regni vegetabilis (. . .).* (Treuttel et Wartz: Paris.)
Cohn, H.M. (1989). Ferdinand Mueller, Government Botanist: the role of William Hooker in his appointment. *Muelleria* 7(1):99–102.
Dalziel, R. (1981). The politics of settlement. *In* Oliver, W.H. (ed.), *The Oxford history of New Zealand.* (Clarendon Press: Oxford.) pp.87–111.
Dance, S. P. (1978). *The art of natural history: animal illustrators and their work.* (Country Life Books: London.)
Desmond, A. (1985). The making of institutional zoology in London 1822–1836. *Hist. Sci.* 23:153–185, 223–250.
Di Gregorio, M.A. (1983). In search of the natural system: problems of zoological classification in Victorian Britain. *History and philosophy of the life sciences* 4(1):225–254.
Diels, L. (1906). *Die Pflanzenwelt von West-Australiens suedlich des Wendekreises.* (Engelmann: Leipzig.)
Farber, P.L. (1985). Aspiring naturalists and their frustrations: the case of William Swainson (1789–1855). *In* Wheeler, A & Price, J.H. (eds), *From Linnaeus to Darwin: commentaries on the history of biology and geology.* (Society for the History of Natural History: London.) pp.51–59.
Fox, P. (1989). Daniel Bunce, gardener and botanical explorer. *Australian garden history* 1(2): 7–11.
Galloway, D.J. (1978). The botanical researches of William Swainson F.R.S., in Australasia, 1841–1855. *J. Soc. Biblphy nat. Hist.* 8(4):369–379.
Gillbank, L. (1992) Alpine botanical expeditions of Ferdinand Mueller. *Muelleria* 7(4):000–000.
Gould, S.J. (1984). The rule of five. *Nat. Hist.* 93(10):14–23.
Günther, A.C.L.G. (1900) An analysis of the Swainson correspondence presented to the Linnean Society entitled 'The unpublished correspondence of William Swainson with contemporary naturalists (1806–1840)'. *Proc. Linn. Soc. London* 112th session:25–61.
Gunther, A.E. (1984). *The founders of science at the British Museum 1753–1900.* (Halesworth Press: Halesworth.)
Holden, R.H. (1966). Daniel Bunce. *Australian dictionary of biography* 1:176–177.
Hooker, W.J. (1854). Mr Swainson's botanical report, principally relating to the Eucalypti and Casuarinae of Victoria, New Holland. *Hooker's J. Bot. Kew Gard. Misc.* 6:186–190.
Jackson, B.D. (1885) *Index kewensis (. . .).* (Clarendon: Oxford.)
Jackson, C.E. (1975). *Bird illustrators: some artists in early lithography.* (Witherby: London.)
Jussieu, A.L. de (1789). *Genera plantarum (. . .).* Viduam Herissant et Theophilum Barrois: Parisiis.)
Knight, D.M. (1977). *Zoological illustration: an essay towards a history of printed zoological pictures.* (Wm Dawson & Son: Folkstone.)
Knight, D.M. (1986a). *The age of science.* (Basil Blackwell: Oxford.)
Knight, D.M. (1986b). William Swainson: naturalist, author and illustrator. *Archives of natural history* 13(3):275–290.
Lehmann, J.G.C. (1844–1848). *Plantae preissianae (. . .).* (Meissner: Hamburg.)
MacLeay, W.S. (1819–21). *Horae entomologicae; or essays on the annulose animals.* (Bagster: London.)
MacLeay, W.S. (1830). On the dying struggle of the dichotomous system. *Philos. Mag. Ann. Chem.* 7:431–445; 8:53–57, 134–140, 200–207.
McMillan, N.F. (1980). William Swainson (1789–1855) and his shell collections. *J. Soc. Biblphy nat. Hist.* 9:427–434.
Maiden, J.H. (1902). Presidential address. *Proc. Linn. Soc. New South Wales* 26:740–805.
Maiden, J.H. (1908). Records of Victorian botanists. *Victorian Naturalist* 25:101–117.
Miquel, F.A.W. (1848). *Revisio critica casuarinarum.* (Sulpke: Amstelodami.)
Morton, A.G. (1981). *History of botanical science.* (Academic Press: London.)
Mueller, F. (1850). Notes on South Australian botany. *South Australian register*, Adelaide 14(1048):3.
Mueller, F. (1852). Der Murrayscrub, botanisch skizzirt. *Hamburger Garten- Blumenzeitung* 8: 81–83.
Mueller, F. (1853). First general report of the government botanist on the vegetation of the Colony. *In* Victoria. Parliamentary Papers. Votes and Proceedings of the Legislative Council 1853 I (A. No. 26a & b). The original of this document is in VPRS 1189, unit 203, C53/8928.
Mueller, F. (1854). Second general report of the government botanist on the vegetation of the Colony. *In* Victoria. Parliamentary Papers. Votes and Proceedings of the Legislative Council 1854–5 I (A. No. 18).
Mueller, F. (1857). Nova genera et species aliquot rariores in plagis australiae intratropicis nuperrime detecta. *Hooker's J. Bot. Kew Gard. Misc.* 9:14–24.
Mueller, F. (1860–1862). *The plants indigenous to the colony of Victoria.* (Government Printer: Melbourne.)
Mueller, F. (1864). *Vegetation of the Chatham Islands.* (Government Printer: Melbourne.)
Mueller, F. (1879–1884). *Eucalyptographia: a descriptive atlas of the eucalypts of Australia and the adjoining islands.* (Government Printer: Melbourne.)
Mueller, F. (1882). *Systematic census of Australian plants, with chronologic, literary and geographic annotations.* (McCarron Bird: Melbourne.)
Mueller, F. (1889). *Second systematic census of Australian plants, with chronologic, literary and geographic annotations. Part 1 — Vasculares.* (McCarron Bird: Melbourne.)

Natusch, S. & Swainson, G. (1987). *William Swainson of Fern Grove F.R.S., F.L.S., etc: the anatomy of a nineteenth century naturalist.* 3rd ed. (Sheila Natusch: Wellington.)
Oldroyd, D.R. (1980). *Darwinian impacts: an introduction to the Darwinian revolution.* (New South Wales University Press: Kensington.)
Parkinson, P. (1985). William Swainson 1789–1855: relics in the Antipodes. *Bull. Roy. Soc. New Zealand* 21:49–63.
Paszkowski, L. (1967). William Blandowski — the first Government Zoologist in Victoria. *Austral. Zool.* 14:147–172.
Pescott, E.E. (1950). The writings of Daniel Bunce, 1838–1872. *Victorian historical magazine* 23:115–125.
Pretty, G.L. (1967). Edward Gibbon Wakefield. *Australian dictionary of biography* 2:559–562.
Richardson, J. & Swainson W. (1831). *Fauna boreali-americana; or the zoology of the northern parts of British America (. . .). Part II. The birds.* (Murray: London.)
Ross, J.H. (1976) An analysis of the flora of Victoria. *Muelleria* 3(3):169–176.
Rupp, H.R.M. (1941). An early Victorian botanist. *Victorian Naturalist* 58:30–31.
Stearn, W.T. (1939). Lehmann's 'Plantae preissianae'. *J. Soc. Biblphy nat. Hist.* 1:203–205.
Stearn, W.T. (1962). *Three prefaces on Linnaeus and Robert Brown.* (Cramer: Weinheim.)
Swainson, W. (1820–23). *Zoological illustrations, or original figures and descriptions of new, rare, or interesting animals (. . .).* (Baldwin Cradock: London.)
Swainson, W. (1835a). On the series of nature, and on the relations of animals. *Entomol. Mag.* (London) 3:1–12.
Swainson, W. (1835b). *A preliminary discourse on the study of natural history.* (Longman: London.)
Swainson, W. (1837). *Birds of West Africa.* (Longman: London.)
Swainson, W. (1838a). *Flycatchers.* (Lizars: Edinburgh.)
Swainson, W. (1838b). A short reply to my reviewers. *Mag. Nat. Hist.* ns, 2:494–498.
Swainson, W. (1840). *Taxidermy; with the biography of zoologists and notices of their works.* (Longman: London.)
Swainson, W. (1853). Botanical report of William Swainson, Esq., F.R.S. *In* Victoria. Parliamentary Papers. Votes and Proceedings of the Legislative Council 1853/4 II (A. No. 29a).
Walpers, W.G. (1848–1849). *Annales botanicae systematica. Tomus I.* (Hofmeister: Lipsiae.) pp.739–745.
Womersley, H.B.S. & Sinkora D. M. (1987) Ferdinand Mueller's earliest Australian plant collections. *Austral. Syst. Bot. Soc. Newslett.* 52:11–13.

Revised manuscript received 8 October 1991

BOOK REVIEW

A taxonomic revision of *Lamium* (Lamiaceae). Mennema, J. (1989). Leiden Botanical Series, Volume 11. Leiden University Press. *c.*US$46.00

It is always welcome to see some of the north temperate genera under taxonomic scrutiny — here the temperate Eurasian (holarctic) genus *Lamium* L. This continues the work on the Lamiaceae in the Leiden Botanical Series following a similar format to the volume 4 revision of *Origanum* in 1980.

This is a fairly extensive work of 198 pages. The citation (in small print) of the *c.*10000 specimens examined (extending over sixty pages of text) is a publication luxury few Herbaria can now afford and there is quite lengthy citation in the synonymy.

The treatment includes one new section and nine new combinations below specific rank. With about 40–50 species usually attributed to the genus, many have obviously been reduced to lower rank or synonymy in the description of 16 species, 11 subspecies, 13 varieties and one hybrid. It is pointed out that the concept of *Lamium* '. . . is mainly not characterised by the presence of certain characters but by their absence' and has traditionally been '. . . a repository of *insertae sedis Labiatae*'. In spite of this, *Lamium* is diagnosed polythetically and the original concept '. . . from Linnaeus (1759) to Briquet (1897)' retained, the characters used being essentially those of gross morphology with the dimensions of various structures extensively graphed.

In our current era of phylogenetic systematics I do not think the section *An Intuitive Phylogenetic Reconstruction* beginning '. . . I start from the axiom, that species with a large, disjunct distribution area are older than species with a small and continuous area' would be likely to impress with its methodology. A tree illustrating the intuitive phylogenetic relationships of the species clearly shows the subgenus *Lamium* as a paraphyletic group.

Only one species of *Lamium* is widely cultivated in Australia, a silvery-leaved variant of *L. galeobdolon* (L.)L.f. sometimes listed under *Lamiastrum galeobdolon* (L.)Ehrend. & Polatschek and called Aluminium Plant (*Pilea cadierei* Gagnep. & Guillaum. is perhaps better known under this common name). Evidently this garden plant has become an important garden escape in various parts of Europe over the last decade. Anticipating more publication of naturalisation it has been given formal botanical status as *Lamium galeobdolon* (L.)L.f. f. *argentatum* (Smejkal)Mennema. It has not, so far as I am aware, become weedy in Australia. Two species are naturalised on cultivated land in Australia and New Zealand, *L. amplexicaule* L. and *L. purpureum* L. These remain essentially unchanged except for cleistogamous plants of the former found in South Australia: somctimes placed in *L. amplexicaule* L. var. *clandestinum* Reichb. they are now in synonymy under var. *amplexicaule*.

Unfortunately the English is occasionally rather stilted and with unusual punctuation. There are also occasional unnerving semantic shifts where related but inappropriate English words have (presumably) been substituted for the Dutch. This is noticeable for instance in the key to all taxa except hybrids. Couplet 5(2) reads 'Leaves at the utmost as long as broad, usually shorter than broad', couplet 6(1) 'Plant larger, 10 cm or longer, with larger leaves, 1 cm or longer.'

This is a solid piece of work in a genus clearly needing attention. The plant illustrations are of a high standard.

R. SPENCER

BOOK REVIEW

The Macmillan Dictionary of the Australian Environment. David Meagher. Published by The Macmillan Company of Australia Pty Ltd, Melbourne. 1991. viii + 366 pp. & 6 maps. ISBN 0 7329 0340 4 (paperback). Price $AU29.95.

There are a lot of dictionaries in circulation. They range from pocket guides to French or Latin, to purportedly comprehensive guides to just about any subject. David Meagher's dictionary falls somewhere between these two extremes. The subject is of such a vague nature that it could never hope to be comprehensive and, besides being too big for a pocket, it contains too many esoteric terms to interest the casual reader. It is a dictionary designed for those who write or read about the Australian environment. Given this audience, is David Meagher providing a compendium of definitions which is not readily available elsewhere, or at least improving upon existing dictionaries?

On the positive side, the layout is good and the entries are easy to find. Cross-referencing is extensive and logical. Appendices include lists of endangered and extinct animals and plants, international treaties and SI unit conversions. Following a brief bibliography there is a series of maps showing geographical, climatic and biotic regions, and major mining locations, in Australia. So the coverage is broad.

Unfortunately, I don't think this neatly produced book is an 'essential reference work' or 'an invaluable guide for students and the lay person interested in the environment' (as is suggested on the back cover). The major problem is that David Meagher has tried to cover *too* broad a range of topics. A slimmer volume concentrating on terms not covered by currently available dictionaries would have been of greater value. This would also have allowed him to leave out a range of words which I think are poorly or misleadingly defined. The obvious rejoinder to such criticism is that few people have access to these other dictionaries and it is worthwhile collating relevant terms together in one publication. Besides creating a never-ending network of dictionaries, such a rationale would require an extremely judicious choice of words, all provided with accurate and precise definitions (so that one doesn't have to regularly seek out supplementary dictionaries). *The Macmillan Dictionary of the Australian Environment* does not meet these criteria.

It may seem trite to extract and analyse individual words as a means of judging the whole book, but I only do so to emphasize a few general points. Most common morphological terms are defined — you will find *ovate* but not *trullate* — but without illustration (you will have to look through your state floras and faunas to find such pictures). However, is this definition of ovate much use: 'having a broad base and a narrower apex'? Does that mean shaped like a wine-flagon, a pyramid, a buddha or a section through the long-axis of an egg? For botanical topics, I would use *A Glossary of Botanical Terms* (by B. D. Jackson) or *Botanical Latin* (by W. T. Stearn) to get a more comprehensive range and more precise definitions.

David Meagher states in his introduction that animal and plant taxa are listed down to family level (although the occasional genus pops up, e.g. the seal genus *Otaria*). He then goes on to apologize for the 'notable' absence of insects from his definitions. No mention is made of families of bacteria, algae, fungi, mosses and ferns, which are also notably missing. Of course their omission could be justified, as are the insects, by the lack of suitable information. But it isn't. Once again I don't see the point of including this selection of taxonomic titbits. The information is available in books such as *The Plant Book* (by D.J. Mabberley), *Flowering Plants and Ferns* (by J.C. Willis) and similar books for animals.

Nomenclatural terms are obscurely and often incorrectly defined. For example, a *paratype* is not just 'a specimen, other than a holotype (or replacement holotype) that is left over from the original material after the taxonomic description and classification of an organism has been made". For a start, what is the "original material'. Even if you understand such allusions, the definition is still

incorrect. A paratype is, at least in the *International Code of Botanical Nomenclature*, a specimen cited in the protologue other than the holotype *or* isotype (or syntypes). The point is that such terms cannot be described simply and should have been left out. No-one is going to want a vague definition of a nomenclatural term.

Other annoying lapses are to be found. *Cladistics* is defined on the basis of a minor criticism of the method, which does nothing to explain what this rigorous and informative technique has to offer to taxonomy. Once again, it would have been better to leave it out. *Keystone species* is defined as a 'critical species'. Does this help? If such definitions were tightened up, and all morphological, nomenclatural and systematic terminology removed, the resultant slimmer (?and cheaper) book would nicely complement the existing array of dictionaries. It would still include such diverse terms as *cinnamon fungus*, *clearfelling*, *lead arsenate*, *Churchill National Park*, *Claus kiln*, *World Heritage List* and *Ranger Inquiry*. These are the terms I will be looking for when I use *The Macmillan Dictionary of the Australian Environment*.

TIMOTHY J. ENTWISLE

CONTENTS

Volume 7, Number 4 Page

Plectranthus blakei (Lamiaceae), a new species from central Queensland
— Paul I. Forster 417
A note on *Plagiocarpus* Benth. (Fabaceae: Brongniartieae)
— J.H. Ross 421
The setaceous species of *Batrachospermum* (Rhodophyta): a re-evaluation of *B. atrum* (Hudson) Harvey and *B. puiggarianum* Grunow including the description of *B. diatyches* sp. nov. from Tasmania, Australia
— T.J. Entwisle 425
A new species of *Pomaderris* Labill. (Rhamnaceae) from north-east Victoria
— N.G. Walsh 447
New taxa in Victorian Poaceae (2)
— N.G. Walsh 451
Chromosome number determinations in *Brachyscome* Cass. (Asteraceae: Astereae) with comments on species delimination, relationships and cytogeography
— K. Watanabe and P.S. Short 457
Alpine botanical expeditions of Ferdinand Mueller
— Linden Gillbank 473
Ptilotus eriotrichus (Amaranthaceae) revisited
— P.S. Short 491
Lectotypification of *Fumaria muralis* Sond. ex Koch (Fumariaceae)
— N.G. Walsh 495
Two new species of *Eucalyptus* (Myrtaceae) in south-eastern Australia
— K. Rule 497
A new species and new records from the Tasmanian lichen flora
— Gintaras Kantvilas & John A. Elix 507
Some nomenclatural changes in the Angianthinae and Cassiniinae (Asteraceae: Gnaphalieae)
— Paul G. Wilson, P.S. Short & A.E. Orchard 519
A new species of *Lobelia* L. (Campanulaceae: Lobelioideae) from Victoria and South Australia
— David Albrecht 525
'Such ingenious Birds': Ferdinand Mueller and William Swainson in Victoria
— Sara Maroske & Helen M. Cohn 529
Book Review: A taxonomic revision of *Lamium* (Lamiaceae)
— R. Spencer 555
Book Review: The Macmillan Dictionary of the Australian Environment
— Timothy J. Entwisle 557

ISSN 0077–1813

Brown Prior Anderson Pty Ltd, Burwood, Victoria